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COVER NOTE

from:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	8 September 2010
to:	Mr Pierre de BOISSIEU, Secretary-General of the Council of the European Union
Subject:	COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL MARINE KNOWLEDGE 2020 COMMISSION STAFF WORKING DOCUMENT European Marine Observation and Data Network IMPACT ASSESSMENT

Delegations will find attached Commission document SEC(2010) 998 final.

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EUROPEAN COMMISSION

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COMMISSION STAFF WORKING DOCUMENT

European Marine Observation and Data Network
IMPACT ASSESSMENT

COM(2010) 461
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IMPACT ASSESSMENT

IMPACT ASSESSMENT

1 CHANGES INTRODUCED SINCE PREVIOUS VERSION

The main changes introduced since the previous version are:

The glossary has been shifted to annex 1.

A summary of the stakeholder consultation was shortened considerably. More details on the stakeholders who participated and the compliance with consultation guidelines have been moved to annex 2. A separate document provides a complete analysis of the replies.

Section "3.2 Proportionality – Magnitude of current expenditure" has been updated to reflect better estimates of the current level of spending on marine data in the EU. Some detailed tables have been shifted to annex 3.

Section "3.4 Who is affected?" has been expanded to provide a more detailed estimate of the opportunity costs of the present fragmented data infrastructure in Europe.

Section "3.5 Baseline" showing the current actions underway has been shortened with the longer description retained as annex 4. However subsection "3.5.3 Current data availability" has been added. It aims to show the current data availability, highlighting gaps and deficiencies for the different types of data – bathymetric, physical, chemical etc

Section "6.1.2 competition" provides some examples of innovative services that could develop.

Table 5 in section "7.1.3 Economic impacts" has been updated in the light of the completion of a study on the costs of marine data.

Section "7.1.7 Interim Period 2011-2013" has been added. It now provides more information on the actions planned the period 2011-2013

And section "7.1.8 Afterwards" tentatively suggests priorities for the operational period starting in 2013.

2 PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

2.1 Identification

This impact assessment is led by DG-MARE. It is contributing to the setting up of a European Marine Observation and Data Network (EMODnet). The agenda planning reference is 2009/MARE/003. This Network was announced in the EU's Maritime

Policy Blue Book[1] which was welcomed by the European Council in December 2007. While this impact assessment specifically addresses EMODnet as one of the actions under Maritime Policy, the Communication to be presented in March 2010 will embed EMODnet in the wider Commission efforts to gather data relevant for maritime affairs. This assessment further establishes the need and legitimacy of funding such an activity at an EU level. But it does not unequivocally identify the source of such funding.

The report commits only the Commission's services involved in its preparation and does not prejudge the final form of any decision to be taken by the Commission.

2.2 Organisation and timing

2.2.1 preparation

The formulation of an integrated maritime policy was a strategic objective of the Commission's 2005-2009 workplan[2]. Improving maritime knowledge has been a key aim of this policy from the outset.

Accordingly the Commission proposed a new European Marine Observation and Data Network (EMODnet) in its maritime policy Green Paper[3]. Following an overwhelmingly positive response from stakeholders to its proposal, the European Commission, in its EU's Maritime Policy Blue Book[1], adopted in October 2007 and welcomed by the European Council in December 2007, undertook to take steps towards EMODnet in order to improve availability of high quality data. The impact assessment is part of a process that started immediately after the adoption of the Blue Book on maritime policy in October 2007. A subgroup of the maritime policy inter-service group specialising in data and observation issues has been meeting regularly since then. An expert group was set up, web-sites (both for outside stakeholders and for Commission services) established, preparatory actions launched to assess feasibility and studies prepared to explore legal and economic issues.

Following the publication of the roadmap for EMODnet[4] the inter-service subgroup was strengthened. It now acts as the Impact Assessment Steering Group and includes COMP, ENV, EEA[5], JRC, INFSO, MARE (including representatives from both maritime policy and fisheries) and RTD. The first meeting was 31 March 2009. It held meetings 31 March 2009, 8 May 2009, 29 May, 2009 and 11 September 2009.

A first assessment was sent to the Impact Assessment Board on 22 June 2009. A revised version was sent on October 14 2009.

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1 An Integrated Maritime Policy for the European Union Brussels, 10.10.2007 COM(2007) 575 final

2 Strategic Objectives 2005 – 2009 Europe 2010: A Partnership for European Renewal Prosperity, Solidarity and Security 26.1.2005 COM(2005) 12 final

3 Towards a future Maritime Policy for the Union: A European vision for the oceans and seas 7.6.2006 COM(2006) 275 final

4 Building a European marine knowledge infrastructure: Roadmap for a European Marine Observation and Data Network, SEC (2009) 499 (final), 4 April 2009

5 European Environment Agency

2.2.2 present status

Preparatory actions started in May 2009. This is the financing mechanism for setting up a prototype ur-EMODnet. Consortia are assembling bathymetric, geological, chemical and biological data for a limited number of sea-basins and making them available through the internet. Users will be able to see the distribution of marine data around the seas-basin, understand where the gaps are, enjoy free use of data and report back their experiences. The budget is €3,450,000. A second call for tender was issued in 2009 for €1,200,000 and a further one of a similar magnitude will be launched in 2010. The first results are expected mid-2010. Lessons learned in operating and using the ur-EMODnet will be taken into account in setting up the subsequent operational EMODnet. Ur-EMODnet is described more fully in section "3.5 Baseline".

2.2.3 next steps

During the process of defining EMODnet, a number of stakeholders have indicated that whilst they agree with the aims of EMODnet, they would like to understand how it is positioned within an overall EU strategy, encompassing also ongoing efforts to improve access to fisheries data, to build an infrastructure for global monitoring for environment and security (GMES)[6] and to develop a shared environmental information system[7]

Accordingly a Communication on marine knowledge is being prepared for early 2010 that will outline a set of common objectives for marine knowledge, show how the different initiatives already underway are contributing to those objectives, demonstrate how they fit together, point out where the remaining gaps are, set out a vision for the future and provide a timetable for moving ahead.

Whilst the Communication will set out a vision for the architecture of an operational EMODnet, it will not include a decision as to its final ambition, scope and shape. This decision will be taken in 2012 or 2013 once more evidence has been accumulated through the prototype ur-EMODnet.

However the current ur-EMODnet being set up under the preparatory actions will not in itself provide sufficient information for a rational decision to be made in 2012 or 2013. The sample is too small. The number of parameters and sea-basins covered are fewer than would be needed to satisfy the needs of the marine and maritime community. The resolution is too coarse. It would be too great a jump and too risky a venture to move straight from the preparatory-action-based ur-EMODnet to a full-blown EMODnet of the scale that current estimates (set out in section 6.1.4 "Implementation costs") indicate will be necessary.

Inaction till 2013 would cause the initiative to lose momentum and not allow it to react to evolving developments in the marine and maritime world. It is therefore intended that a set of intermediate actions be launched to follow-up the preparatory actions and lay down the basis for a better decision.

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6 Global Monitoring for Environment and Security (GMES): we care for a safer planet Brussels, 12.11.2008, COM(2008) 748 final

7 Towards a Shared Environmental Information System (SEIS) COM/2008/0046 final

Separate Commission proposals in the form of new or modified Regulations, with or without a financial component, will build on the assessment in this document and follow the marine knowledge Communication. This could be within the framework of a new Regulation that is under consideration for 2010 with the object of establishing a programme to support the Integrated Maritime Policy in 2011-2013. However other financial mechanisms may be considered.

2.2.4 scope of this impact assessment

This is an appropriate time to take stock of what has been done. An impact assessment at this stage allows a clarification of the options for the operational-EMODnet and will therefore drive the actions that need to be taken in the period leading up to the operational phase.

The assessment, however, cannot identify precisely the implementation costs of the full operational EMODnet. The fragmentation of data that prompted the development of EMODnet in the first place is a major factor in making it hard to determine the costs of remedial action. But an assessment at this stage of the policy development provides a concrete and transparent baseline for further discussion that can be progressively refined as more information becomes available through ur-EMODnet and other means.

The assessment therefore should justify the continuing intermediate efforts by the Commission to develop EMODnet after the expiry of the integrated maritime policy action plan in October 2009 by showing the need for action and providing a first assessment of the options in terms of costs and benefits for the long-term development of EMODnet post-2014. Any intermediate steps involving a financial component will be accompanied by an additional ex-ante evaluation.

2.3 Consultation and Expertise

2.3.1 Outside Expertise

An independent Marine Observation and Data Expert Group (MODEG) met 7 times up to the end of 2009 to provide input and feedback to the Commission's plans. In mid-2009 preparatory actions for a total of €3,450,000 began to assess the technical options for setting up a network and to obtain first estimates of the likely cost of setting up an operational capability (see section 2.2.2). Two studies have been launched for a total of €500,000[8]. The first, completed in 2008, clarified legal barriers to marine data access and re-use[9]. The second[10] mapped out what Member States are spending on their current marine data infrastructures, determined the opportunity cost of its fragmented nature and assessed legal options for EU action.

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8 Half of a €500,000 legal study that also covered other issues and a study on economic issues for €250,000

9 Legal Aspects of Marine Environmental Data Framework Service Contract, No. FISH/2006/09 – LOT2, final report, October 2008

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

2.3.2 Stakeholder Consultation

The ambition to set up a Marine Observation and Data Network was first aired in public through the Green Paper on maritime policy[11]. 487 stakeholders replied including the national administrations of all EU coastal states and more than 100 local authorities. Although there were various suggestions as to how such a network should be constructed, opinion was overwhelming that such an initiative was needed. The Commission therefore included a proposal to take further steps in its Blue Book on maritime policy in October 2007.

Following further consultation with the Marine Observation and Data Expert Group and after gathering feedback from presentations at a number of gatherings of marine specialists, a roadmap was produced in April 2009 setting out broad principles and a timetable for moving ahead.

Simultaneously a new public consultation was launched. 300 stakeholders replied in two months - 42% on behalf of their organisations, 46% from a personal viewpoint but based on their working experience and 12% from a general concern about the sea (12%). The sample included representative sub-samples from private companies, public authorities, the research community and "others".

Nearly all stakeholders need more than one class of data. Each class of data was useful to at least 60% of stakeholders. 90% of stakeholders required physical and bathymetric data with more than 60% expressing strong needs. These results are consistent with a 1999 analysis by EuroGOOS[12] which provided a more detailed breakdown on the type of data required.

The roadmap identified 8 principles for a sustainable marine data infrastructure. Stakeholders were asked their opinion on these principles. 70% strongly agreed and 90% in total agreed with the first five principles - provide sustainable financing at an EU level, interoperability, multi-use of data, marginal costing and statements on ownership, accuracy and precision Agreement on the other three was also strong but somewhat lower. Approximately 40% strongly agreed and 80% in total agreed that data should be processed at a sea-basin level, that it should build on existing effort and that a decision-making process should be developed that is user-driven.

The consultation met the Commission's standards for impact assessment consultations. The complete outcome is reported in a separate document[13] and summarised in annex 1. Relevant elements are inserted wherever appropriate throughout this report.

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11 COM(2006) 275 final

12 Operational Oceanography Data Requirements Survey EuroGOOS Publication No. 12 February 1999, EG99.04

13 Marine Data Infrastructure: public consultation. Commission Staff Working Document, 2009.

3 PROBLEM DEFINITION

3.1 Issue

3.1.1 Need for coherent approach

It is now well-known that the rhythms and cycles of the marine world influence human activity in a multitude of ways. For instance the abundance and diversity of marine life influences the provision of food; changes in seabed sediments influence coastal erosion and ocean circulation is a primary, if poorly-understood, influence on the terrestrial climate. Since the industrial revolution humans have, in return, begun to exert an increasing influence on the marine world. But the magnitude of future changes in oceanic systems, their impact on human activity and the feedbacks on the ocean from these changes in human behaviour cannot be forecast without understanding the way the system works now and how it worked in the past. Understanding these interactions requires knowledge and observational data which is continuously updated to monitor change.

At present most marine data collection is focused on meeting the needs of a single purpose - as part of a regulatory requirement, for operational purposes or to further scientific understanding.

However using marine data – to assess the state of the ocean, to plan new infrastructure or to analyse its impact on the ecosystem – cannot rely on data from one source collected for a single purpose. Atmospheric processes influence ocean currents which influence the diversity and distribution of marine organisms which influences fishing practices which influence ecosystem health. Therefore applying marine data inevitably requires assembling data collected from a variety of sources into a seamless picture.

Since each country's territorial or jurisdictional waters are part of a dynamic global system connected by shifting winds, seasonal currents and migrating species, analysing the processes that govern the present state and future behaviour of these waters cannot rely exclusively on data collected within that country's own jurisdiction. Cooperation across borders is needed to plan the observation system and to manage data and data products.

3.1.2 Barriers to application of marine data

Assembling a coherent picture is hard work. A recent study[14] confirmed the large number of organisations holding and owning marine data. For France[15] five organisations were identified as owning hydrographical data, eleven geological data, ten physical oceanography data, eight biology data (excluding fisheries), four fisheries data, six chemical data and eight human activity data. There was similar fragmentation in other Member States.

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[14] Legal Aspects of Marine Environmental Data Framework Service Contract, No. FISH/2006/09 – LOT2, final report, October 2008

[15] France is used as an example because the sample of data was checked by a member of the MODEG and can be considered more reliable than the other data collected within the study. The number quoted is a minimum. There may be other data that was not discovered during the study.

From the user's point of view, there are at least seven major barriers to obtaining the data required (1) discovery – not being able to find them (2) access – not having permission to access them (3) use – restrictions imposed on end-use; for instance "for research purposes only" (4) coherence – difficulty combining data from different sources (5) cost – beyond the budget of the user (6) quality – precision and accuracy unknown (7) quantity – spatial and temporal resolution not sufficient for the purpose.

This is confirmed by the stakeholder survey showing that an overwhelming number of users in the public and private sector are unsatisfied with the status quo (see Figure 1). Nearly all stakeholders reported that these barriers constituted an impediment to their working efficiency with significant numbers (about 40%) indicating that these were severe barriers. These barriers not only raise costs but also mean that data does not arrive in time to meet operational requirements.

The only outlier is cost. Although most stakeholders from the private sector and the research community felt that the cost of data was a barrier to their effectiveness, the survey indicates that this was not the major issue for public authorities. This may be because they already obtain the data free of charge. 90% of stakeholders thought that data collected with public funding should be should be available at marginal cost[16].

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Figure 1 dissatisfaction of stakeholders of marine data with the status quo. They were asked to assess how the 7 barriers affected their work.

3.1.3 Competition

These barriers to access and use of marine data mean that a public or private body cannot deliver a product or service that is based on data, for instance an assessment of fish stocks in a particular area, unless it has itself collected the data or enjoys a strong relationship with the organisation that did. This reduces the number of bodies that are potentially able to deliver the product or service. A 2009 review of the Public Sector Information Directive[17] found that re-users in the geographical and meteorological sectors complained of high prices, restrictive licensing conditions and discrimination from data holders in the public sector who themselves provide added-value services from these data.

3.1.4 Uncertainty

The lack of an effective marine data infrastructure compounds uncertainty in the ocean's future behaviour.

Sea-level rise is a good example. Under the ECHAM B2[18] socio-economic scenario, projecting sea-level-rise between 22.6 cm and 50.8 cm by 2100, Richards and Nicholls estimate the annual cost of adaptation, aggregated at EU level under

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16 For data delivered over the internet, the marginal cost approaches zero

17 Re-use of Public Sector Information – Review of Directive 2003/98/EC, Brussels, 7.5.2009, COM(2009) 212 final,

18 ECHAM is Max Planck Institute's climate model. B2 is an IPCC scenario The B2 scenarios are of an ecologically friendly but divided world with continuously increasing population but at a slower rate than A2.

'optimal' protection (costs versus benefits), between € 0.49 billion and € 0.85 billion by 2020. Assuming that engineers are being precautionary in assuming the 50.8cm rise then a 25% reduction in uncertainty can reduce the annual costs of adaptation by €100 million per year. Clearly these calculations include many assumptions but they do provide an indication of the benefit of reducing uncertainty. This is discussed further in section 6.1.3

3.2 Proportionality – Magnitude of current expenditure

The fragmented nature of the current marine monitoring infrastructure that was described in section 2 makes it hard to determine the current observation effort and to quantify the time and effort spent processing the data. However the study undertaken as part of this impact assessment[10] did come up with some estimates.

There are relatively few earth observation satellites that are used for ocean observation so calculating their annual cost including construction, launch and operation is feasible. Dividing this cost for each satellite between land and ocean is trickier but the European Space Agency reckons that Europe currently spends €415 million annually with an error of ±25% in monitoring the oceans.

It is much harder to calculate the rest. An estimate of €815 million for the EU as a whole was obtained by calculating the spending by France, Netherlands, Spain and UK and scaling-up using GDP as a weighting,. The figure for the four countries includes spending by bodies responsible for national defence, coastguards, fisheries, environmental standards and research but is certainly not exhaustive. Some reviewers of the report indicated that it had neglected some spending by local authorities responsible for ports or coastal protection. However the authors were unable to come up with figures for this spending.

Private companies also spend considerable amounts. The study highlighted one Dutch company specialising in marine data with an annual spend on data of €1.5 billion. Much of this is specialised geological data for mineral prospecting that cannot be made publicly available but it also includes data on waves, currents and tides that could be more widely used.

It is therefore safe to assert that EU Member States are currently spending more than €1 billion a year in public money collecting, archiving and distributing marine data and that European private companies are spending more: at least €3 billion per year. These costs illustrate the approximate scale of the activity.

More details of these calculations are provided in annex 3

3.3 Drivers

By their nature marine data already fulfil one necessary condition of a public good - consumption by one individual does not reduce availability of the good for consumption by others. It is therefore in the public interest that marine data produced with public money be as widely used as possible. Unused data are a lost opportunity and still require expensive maintenance, storage, cataloguing etc.

However whilst it is in an organisation's interest that everybody else facilitates access to data, it might not always be perceived as being in its own interest to make its own

data available. This may be because it can earn an income from the data but, more often, it is because it can derive a competitive advantage through preferential access to the data when delivering products derived from these data. These products could be assessments, forecasts, charts, maps or scientific papers. This is described by the UK's Office of Fair Trading[19]

> *The integration of [both] unrefined and refined information operations within a Public Sector Information Holder also mean they have an incentive to favour their own refined information operations over their business customers that purchase unrefined information to develop their own refined information products.*

In other cases organisations have no particular objection to making their data available but, at the same time, they have no particular incentive or mechanism to do so. What is required is an infrastructure to process available data on a sea-area or sea-basin scale. Individual organisations cannot do this on their own.

Thus the main drivers are incentives that favour the retention of data within organisations and a lack of incentives for them to release them.

3.4 Who is affected?

The total cost of delivering data is much larger than just the cost of collection and distribution - it includes the opportunity costs that come with an uncoordinated approach to data management. As part of their planning to improve matters the United States National Oceanic and Atmospheric Administration, NOAA, have constructed a business case[20] for improving the ocean observing system. The interviews conducted in developing this case led them to believe that these opportunity costs represent at least 25% of the cost of using ocean data to generate products and services. This does not include the lost opportunities of those who, faced with an impenetrable data infrastructure, have simply not chosen to develop new services.

There are no such figures available for Europe but it is universally accepted that data is easier to access in the United States than here. One respondent to the stakeholder survey[13] from the research community pointed out:

> *(...) American data policy is light years better than EU policies. While "Europe" is sending one satellite after the other into the orbit their data is mainly validated with in-situ data in American waters. The ratio of satellite papers dedicated to American or European waters is at least 10:1. Reason: EU in-situ data policies.*

Consultants working on offshore renewable resources uses bathymetry data for European waters obtained free of charge in the United States[10]. It is therefore a very conservative assumption to suggest that the current fragmentation adds 25% to the cost of processing data in Europe.

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19 The commercial use of public information (CUPI), December 2006, OFT861

20 The Business Case for Improving NOAA's Management and Integration of Ocean and Coastal Data, Zdenka Willis, Director, NOAA IOOS Program January 2009

The current situation reduces the efficiency and effectiveness of all those who use marine data - scientists, local authorities and the private sector.

3.4.1 Science

Scientists need a better data infrastructure to increase knowledge of ocean circulation and marine ecosystems. Better knowledge provides economic benefits through better forecasting of the terrestrial climate and a more sustainable exploitation of marine resources. A 2006 project[21] estimated public marine research spending in Belgium, France, Germany, Ireland, Portugal, Spain and UK as an average 0.0000055% of GDP which scaled up to the 22 coastal EU states comes to €650 million annually. The EU Framework Programme funds another €100 million. This does not include all marine research activities. For instance in some countries fisheries research, which was estimated in 1997 as €192 million[22] for the EU, is funded separately. A paper[23] from the European Strategy Forum for Research Infrastructures (ESFRI) suggests that 50% of the marine science budget is spent on infrastructure and collecting data. One can assume that the rest, €400-500 million a year, is spent analysing that data. If the opportunity cost to scientists of a fragmented infrastructure is 25% of this, then it is €100 million per year. In other words if scientists had access to better data then one can expect scientific output indicators such as articles in high quality peer-reviewed journals to increase correspondingly.

3.4.2 National and Local Authorities

National and local authorities require a better data infrastructure to assess the impact of proposed changes in human activities, to protect against coastal erosion or to manage natural resources. The cost of assessing impact of new activities is largely borne by the private sector although public oversight is required. Protecting against coastal erosion is estimated at €700 million per year[24]. Managing natural resources has historically largely been about fisheries although the setting up of marine protected areas and the Marine Framework Strategy Directive have widened the scope. An OECD study[25] reckoned that the EU was spending €400 million on fisheries management and enforcement in 1997. This does not include the research element. Since it is often local authorities who are responsible for environmental measures, it is hard to assemble the data necessary to determine a total EU cost. Two counties in Sweden, Västra Götaland and Norbotten, together spend €2.5 million[10] per year, which is between 10 and 20% of their budget, on processing marine data in order to fulfil their regulatory duties. The advent of marine spatial planning is creating new responsibilities at a national level. The UK is setting up a Marine Management Organisation with 40 new posts (estimated at €6 million) to manage planning and licensing. Scottish waters, which cover a greater area, are under

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21 MarinERA Publication N°1 A Preliminary Description of MarinERA Member State Marine Research Funding Programmes and Implementation Procedures (2006)

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

23 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

24 The economics of climate change adaptation in EU coastal areas, Summary report ISBN 978-92-79-12065-7, May 2009

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

separate management. A reasonable estimate for the total cost of marine management to authorities is €1.5 billion.

The study carried out as part of the impact assessment[10] suggests that 15% of the costs of these authorities responsible for marine management are associated with data processing. Only in the Netherlands were these authorities able to obtain most of the data that they required from third parties. In the UK, France and Sweden most data was either collected by the organisation itself or had to be thoroughly processed before they could be usable. If we again take the 25% for opportunity costs of fragmentation we arrive at an annual cost in the region of €56 million.

This does not include the cost of dealing with uncertainty which is covered in sections 3.1.4 and 6.1.3

3.4.3 Private Companies

Industry requires marine data to exploit resources more efficiently and to assess the environmental impact of their activities. The study[10] determined that marine data was required for oil and gas activities, gravel extraction, renewable energy, pipeline-laying and port maintenance. Many companies contracted out this work to specialist local companies. One Europe-based company specialising in marine data spends more than €1.5 billion annually on collecting and managing marine data for other companies. Data for private companies is largely project related. They are gathered for a particular application and then remain embedded in reports, design reports or impact assessments. They are not generally re-used. A reasonable estimate for the total annual spending by Europe-based private companies is €3 billion.

Although perhaps 80% of these data are commercially valuable and cannot be distributed, many companies indicated that they would be willing to share other data – particularly those above the sea-floor. Furthermore some of these data may already have been collected by public organisations but be difficult to access and use for reasons outlined in 3.1.2. We therefore estimate the companies' opportunity costs of fragmentation as 25% of the 20% - ie €150 million per year.

3.5 Baseline

This is not the first time that such deficiencies have been identified. The European marine data infrastructure issue is part of a wider debate on the potential gains of wider access to public information, of better sharing of scientific data and of more coordinated monitoring of the planet. And the EU has already begun a number of initiatives aiming to alleviate barriers that prevent progress on these issues. These have already been described in the EMODnet roadmap[4]. In this section we summarise the findings and explain how EMODnet fits in with these other actions. A fuller account is provided in annex 4.

These actions include both obligations and enabling measures. The distinction between the two is not always clear-cut but in general obligations are those where EU legislation obliges Member States to collect, assemble or grant access to data and enabling measures are those where the EU provides some support .

3.5.1 Obligations

The EU's primary tools for promoting better discovery of data, freer access to data and fewer restrictions on use of data-use conditions are

1. the INSPIRE Directive[26] which obliges Member States to adopt measures for the sharing of data sets and services between its public authorities,

2. the Environmental Information Directive[27] which requires them to release the data when asked and

3. the Public Sector Information Directive[28] which facilitates the re-use of public data buy by insisting that it is provided to all third parties under the same conditions.

These oblige Member States to adopt appropriate measures in order to achieve the desired objectives. A study[29] clarified why these measures were not sufficient to remove the barriers to the use of marine data described in section 2.2.2. Broadly speaking the study concluded that Member States have correctly implemented the legislation at national level. However they do not necessarily apply to those bodies not exercising public authority that hold much marine data - for instance scientific and academic institutions - and they do not override intellectual property rights. They do not deal with near-real time observations, historic archives of data or cost-recovery charging. A review of the Public Sector Information Directive[30] found that re-users in the geographical and meteorological sectors complained of high prices, restrictive licensing conditions and discrimination.

In other words there is not a problem of non-implementation of existing international and European rules in terms of access to and the use/re-use of marine environmental data, rather that those rules have a limited impact on intellectual property rights and thus in their ability to facilitate data flows.

3.5.2 Enabling Actions

As well as the actions obliging Member States to release data, a number of actions have taken place to facilitate the setting up of a marine data infrastructure. These include:

1. the Data Collection Framework[31] through which the Community provides €44 million annually for the collection of fisheries data. Its latest revision[31] has reduced the restrictions on access and use of data. It now obliges national authorities holding fisheries data to allow access for scientific advice, research

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26 Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community.

27 2003/4/EC

28 2003/98/EC

29 Legal aspects of marine environmental data Framework Service Contract, No. FISH/2006/09 – LOT2, Final Report – October 2008

30 Re-use of Public Sector Information – Review of Directive 2003/98/EC, Brussels, 7.5.2009, COM(2009) 212 final,

31 Council regulation N° 199/2008/EC

and public debate and to grant the Commission access to national computerised databases through bilateral agreements.

2. Framework Programme Projects. A number of projects partly financed by the EU's Framework Programme for research have gone some way towards meeting the objectives of EMODnet. Each of them aims to provide better access to particular types of marine data held by Member States by setting up catalogues, defining standards and developing the algorithms and software necessary to assemble data.

3. Global Monitoring for Environment and Security (GMES) which provides support to marine data infrastructure in two ways – first it contributes towards the funding of satellites to monitor the marine environment and secondly it supports a "marine core service" which can be considered as the forerunner to an ocean forecasting system. This is done on a prototype basis through the MyOcean[32] project which started in 2009 and is funded to the tune of €33 million through the Framework Programme. However from 2014 onwards it is possible that some provision will be made in the EU budget for an operational service.

4. Member States have the obligation towards the Commission and the European Environment Agency under Article.19 of the Marine Strategy Framework Directive to in respect of data and information resulting from the initial assessments and from the monitoring programmes. The Shared Environmental Information System SEIS[33], a collaborative initiative of the European Commission and the European Environment Agency (EEA), is an approach aiming to modernise and simplify the collection, exchange and use of the data and information required for the design and implementation of environmental policy. WISE-marine is the marine component of SEIS.

5. European Agencies. The mandates of the European Maritime Safety Agency and the Community Fisheries Control Agency are more about the enforcement of maritime or fisheries rules than the provision of data for setting up these rules. However the European Maritime Safety Agency does act as a hub for distribution of vessel traffic information which, provided that suitable safeguards regarding commercial confidentiality were observed, might, in an appropriate aggregated form, be disseminated more widely.

6. National Programmes. Member States have also been active. Driven by obligations from the Marine Framework Strategy Directive, marine spatial planning and marine protected areas, Member States are beginning to develop information systems for the assembly, curation and distribution of marine data.

These are all useful contributions but can only provide part of the solution: the Data Collection Framework only deals with fisheries data; GMES only targets services where data from satellites plays a substantial role; SEIS and WISE marine are limited to data that must be reported in the framework of the Marine Strategy Framework Directive; limited duration research projects designed to promote innovation are the

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32 http://myocean.oceanobs.com/

33 Towards a Shared Environmental Information System (SEIS) COM(2008) 46 final Brussels, 1 February 2008

wrong vehicle for supporting long-term observation; European Agencies only hold limited amounts of data and national archives on their own cannot provide the seamless cross-border sea-basin-scale data layers that are required.

EMODnet was specially conceived as a solution to overcome these shortcomings. A prototype version, ur-EMODnet, is being constructed under preparatory action funding. Those from budgetary year 2008 are being implemented by five consortia. Each consortium is responsible for one data theme and aim to develop map layers of two basic types.

1. showing who is collecting data and where it is being collected For instance for bathymetry the map layer will show the position and characteristics of surveys which generally follow the track of a ship.

2. assembling these data into seamless map-layers with public access. For bathymetry the map layers will show a regular grid indicating a water depth at each point of the grid together with an estimate of precision.

Table 1 shows how EU initiatives target the different phases of data processing for each of the main types of data defined in the EMODnet roadmap and the different phases of data processing described in section 5.1.1. EU research projects cover a number of these topics but are not included here because they are not supposed to be permanent structures but rather should be vehicles for the development of expertise and the provision of new methods and tools.

Table 1 How EU initiatives contribute to marine data infrastructure Research projects and national initiatives are not included. Neither are "obligations' such as INSPIRE. The table only covers "enabling measure" financed in part by the EU budget.

Parameter	**collection**	**assembling**	**Application**
Bathymetry		ur-EMODnet	WISE marine
Geology		ur-EMODnet	
Physics	GMES (space)	GMES (except near coast)	GMES
fisheries (including fisheries economy)	Data Collection Regulation	JRC	ICES
Chemistry		ur-EMODnet	WISE-Marine
Biology		ur-EMODnet	WISE Marine
human activity (other than fisheries)			WISE Marine
coastal and maritime economy (except fisheries)		Eurostat	

In order to avoid making wrong choices and in order to fit within the budget allocation for the preparatory actions, ur-EMODnet is being constructed with more modest ambitions than would be necessary for a full EMODnet:

1. Geographical scope. Each category of data is only being assembled over a limited number of sea-basins. All are being assembled in the North Sea which is being taken as a reference and each category of data is also collected over one or more other basins.

2. Range of parameters collected within each theme. The aim has been to assemble representative parameters rather than the complete set - examples of synthetic compounds, heavy metals, radionuclides, fertilisers, organic material and

hydrocarbons for the chemical lot and examples of phytoplankton, zooplankton, angiosperms , macro-algae, invertebrate bottom fauna, bird communities, sea mammals., reptiles for the biological layers.

3. Resolution. High resolution data is best, since it records the maximum possible number of measured points per unit area or per unit of time. It is possible to process high resolution data into lower resolution data by smoothing or averaging, but not the other way round. However producing seamless high resolution map layers over a whole sea basin is difficult because:

    a. processing the data from the raw data is much more time-consuming.

    b. data owners are more reluctant to allow public access to high resolution data than for lower resolution data

    c. in some parts of the sea-basin, the raw data needed to produce the seamless map may be at too low a resolution

    For this reasons some of the ur-EMODnet seamless layers are being produced at a relatively low resolution. The bathymetry map layer will be delivered on a grid one quarter of a minute of longitude and latitude and the geological map at a one to one million scale. These are still at a higher resolution than anything that has been available on a sea-basin scale up to now but for many applications, higher resolution data will be required.

4. Certain data themes are not considered; in particular physical data, fisheries data and human activity data.

    a. fisheries data is dealt with under the Data Collection Regulation for fisheries. It is intended that ur-EMODnet and the Data Collection Regulation become progressively aligned.

    b. Physical data - currents, tides, waves, temperature, density etc - is dealt with by the GMES initiative. There are gaps but it was judged appropriate to wait till these gaps became clearer before embarking on an action to deliver physical data.

    c. Socio-economic data on coastal communities and the maritime economy – employment, profits, age-structure etc. Eurostat are working on improving the quality and comparability of those available at a European level.

Despite these limitations, it is expected that the ur-EMODnet being constructed will not only provide indications of how a future EMODnet will operate but will also provide data that are in themselves useful.

Whilst EMODnet is aimed at providing the material for scientists, public authorities and private bodies with the data they need to provide value added products and services, the European Atlas of the Seas has a wider set of target users. It aims to increase public awareness of the sea, clarify the spatial dimension of EU policies with an impact on the sea and develop the identities of individual sea-basins. Some of the data will be provided by ur-EMODnet. A first version will be published in

January 2010 and subsequently refined. The nature of the Atlas, and its inherent limitations, can never provide the level of detail required for the purposes of EMODnet.

3.5.3 Current data availability

Due to the fragmented nature of Europe's data, and to the relative immaturity of the different initiatives aiming to make access easier for users, it is difficult to assess what the current state of Europe's data is and where the priorities lie for collecting more data. However some early qualitative indications are:

Bathymetry	Though such data are collected by all Member States, many users have to obtain data through less restrictive pathways. Paradoxically it is easier in some cases to obtain the data from NATO, a transatlantic organisation for collective defence, than the national hydrographic offices that collected the data in the first place. The current preparatory actions will produce a grid covering the greater part of European waters at a scale of quarter of a minute (approximately 500 metres). Most marine applications require much finer resolution – between 50 and 100 metres. Raw data in the form of surveys by many organisations exists to produce this finer-resolution layer but it is currently largely unavailable because of licensing restrictions and ignorance as to who holds the data. A first inventory of surveys is being set-up as part of ur-EMODnet.
Geology	Generally each country only has one reference point for archiving and distributing geological data and this facilitates data assembly. The main difficulty is to develop agreed standards. Presently there are no sediment and strata maps covering whole sea-basins although a limited number are being constructed at a scale of one to one million for ur-EMODnet. Finer resolution maps will be more challenging technically.
Physics	Information on physical properties near the coast is not amenable to satellite observation and so is not part of GMES. The SEPRISE project[34] achieved some success in assembling measurements in near-real-time from fixed stations and buoys of sea surface temperature, significant wave height, salinity, sea level, and currents but this project has ended. There is currently no way of obtaining an overview of these measurements in a sea-basin and the data is largely inaccessible.
Chemistry	Ongoing preparatory actions in ur-EMODnet have identified which parameters are required for monitoring the marine Framework Strategy Directive. The main challenges are to understand whether the monitoring density is sufficient to ascertain the quality and precision of measurements and answer questions on environmental

[34] Sustained, Efficient Production of Required Information Services, Specific Support Action, Sixth Framework Programme

status – some of which have been made many years ago. Some Member States are protective of interpretations of chemical data because of possible implications for compliance with environmental regulations.

Biology — Monitoring the abundance and diversity of species requires long time-series and the incorporation of data collected by many different methods. The approach being taken in ur-EMODnet is to build on existing databases such as the Ocean Biogeographic Information System. An early finding is that fewer observations are being aborbed into databases. The number of observations per year peaked in 1995 and descended rapidly thereafter. The reason for this is unknown. It is still a challenge to convert the raw observations into time and space dependent species abundance.

Fisheries — The Data Collection Framework has established a collection strategy that meets the needs of the Common Fisheries Policy but re-use of data assembled for a particular purpose requires the permission of all the individual bodies that provided the data.

Human Activity — Human activity data (other than fisheries) includes parameters such as gravel extraction activity, shipping lanes and aquaculture characteristics. These data are essential for spatial planning or estimating environmental pressure for the Marine Strategy Framework Directive. There are no ongoing efforts by public authorities to assemble such information on a sea-basin basis.

3.5.4 The future

Measures implementing the INSPIRE Directive will continue in the next years and will be essential in establishing a basic set of standards for spatial data. However as we have indicated, these standards on their own will not be enough. They are necessary but not sufficient. "Enabling" as well as "obligation" measures will be required.

The fisheries data infrastructure will continue to improve as measures taken under the revised Data Collection Regulation start to take effect. However the stakeholder survey indicates that nearly all fisheries scientists require other parameters – to determine the impact of the water depth, turbidity, salinity, temperature on spawning or the abundance of predators such as birds or marine mammals on mortality for instance.

GMES will progressively become Europe's reference source of information for satellite measurements of the ocean and model-derived circulation patterns in Europe's seas and oceans. However without a solid infrastructure for non-space measurements, the programme could fail to meet its potential. Furthermore, as we move closer to the coast, finer resolution information is required than can be provided from space. Even if models are available, users need measurements to calibrate them and in order to assess their accuracy.

There are no ongoing efforts other than EMODnet that aim to improve the availability of bathymetry data. The stakeholder survey showed that nearly all investigations into marine behaviour require data on the shape and texture of the sea bottom.

WISE-marine will construct indicators for the environmental assessment of the marine environment largely from biological, chemical and human activity data. Ur-EMODnet will contribute to this process in a limited number of sea-basins. It will show gaps and duplications in the monitoring network and allow sea-basin-scale pictures to be developed. It will be difficult to make progress on WISE marine without further development of the biological and chemical layers of ur-EMODnet.

However the task should not be underestimated. Assessing the biological state of the ocean is undoubtedly more complex than determining its physical or chemical state. Developing meaningful ways of assembling fragmented, uneven data to describe the abundance and diversity of infrequently sampled, short-lived or migrating marine populations will take a sustained effort. Ur-EMODnet brings together for the first time a number of separate initiatives with the aim of assessing the challenges for the whole spectrum of all significant taxa from phytoplankton through seagrasses to marine mammals. But it is just the beginning – analysing the challenges for three species per taxa in a limited number of sea-basins. Ur-EMODnet will need strengthening if this effort is to be effective.

3.6 EU right to act – Treaty basis

The EU's Integrated Maritime Policy has, at its present stage, no explicit Treaty legal basis, but at the same time covers many different policy areas where the Community received explicit powers to act (fisheries, environment, transport, research and technological development, enterprise and industry, etc.) and where the general and specific objectives of EMODnet coincide with those of the Treaty. The specific objectives of EMODnet are primarily aimed at supporting industry, public authorities (and through them the environment) and research through networking. A number of Treaty bases are therefore applicable.

1. Article 157 (1) of the EC Treaty states that "*the Community and the Member States shall ensure that the conditions necessary for the competitiveness of the Community's industry exist*". For that purpose, in accordance with a system of open and competitive markets, their action shall be aimed at inter alia "*encouraging an environment favourable to initiative and to the development of undertakings throughout the Community*" (particularly SMEs) and "*fostering better exploitation of the industrial potential of policies of innovation, research and technological development*". Serving the Community and Member States' industry is one of the specific objectives of EMODnet. The recent proposal for a GMES Regulation[35] is based on Article 157(1), for industrial competitiveness even though a secondary objective is to "*give access to accurate data and information in the field of environment and security under Community control(...) tailored to the needs of a wide range of users*."

[35] COM(2009) 223 final 2009/0070 Proposal for a Regulation of the European Parliament and of the Council on the European Earth observation programme (GMES) and its initial operations (2011–2013)

2. Article 175 of the EC Treaty serves as legal basis for most legal instruments relating to the Community's policy on the environment. This Article grants the Council the power to decide, in certain instances in accordance with the co-decision procedure in Article 251 EC Treaty and following appropriate consultation, what action is required by the Community in order to achieve the objectives of the Community policy on the environment and to adopt the measures necessary for the implementation of the action programmes. EMODnet is explicitly seen as a thematic contribution to SEIS ("the legal implementation of which will provide regulatory powers relevant to EMODnet"[36]), and it closely interacts with the Marine Strategy Framework Directive[37] as it will serve as a "marine data warehouse" for the users of WISE-Marine[38]. Further, environmental policy and decision-making will clearly be able to benefit from EMODnet through improved quality of data, better knowledge of the marine environment, and of the impact of sustainable development policies.

3. EMODnet is explicitly incorporated in the Strategy for Marine and Maritime Research as a tool to support marine scientific research, and it is clear that the scientific research community will be able to benefit from EMODnet. Strengthening marine scientific research is one of the specific objectives of EMODnet. Further, EMODnet will be able to build on existing initiatives under FP7 (such as SeaDataNet or other work on the establishment of e-infrastructures) and may benefit from joint undertakings or other structures set up by the Community to implement its RTD policy in accordance with Article 171 of the EC Treaty[39].

4. Article 154 of the EC Treaty states that: "*to help achieve the objectives referred to in Articles 14 and 158 and to enable citizens of the Union, economic operators and regional and local communities to derive full benefit from the setting-up of an area without internal frontiers, the Community shall contribute to the establishment and development of trans-European networks in the areas of transport, telecommunications and energy infrastructures*". There is direct precedent for the fact that, where the aim of the measure has been to ensure the interoperability of national networks by means of operational measures of a technical nature, Article 156 of the EC Treaty was an appropriate legal basis[40].

Measures can have a dual legal basis. However, the threshold for deeming a measure to have a dual legal basis is quite high. The fact that a certain measure will produce benefits to a Community objective is not sufficient to establish the relevance of that

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36 See EMODNET Roadmap, p. 39.

37 Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) Official Journal L 164 , 25/06/2008 P. 0019 - 0040

38 See EMODNET Roadmap, p. 40.

39 Article 171 of the EC Treaty provides that "the Community may set up joint undertakings or any other structure necessary for the efficient execution of Community research, technological development and demonstration programmes". With regard to ERIC's, see also above.

40 This provision was used as a legal basis to set up EDICOM, the inter-administration telematic network for statistics relating to the trading of goods between Member States (cf. Council Decision n° 96/715/EC of 9 December 1996 on inter-administration telematic networks for statistics relating to the trading of goods between Member States, OJ L 327, 18.12.1996, p. 34, previously Council Decision n° 94/445/EC of 11 July 1994, as annulled by the ECJ by judgement of 26 March 1996 in Case C-271/94).

objective as a legal basis[41]. Nevertheless, it is settled case-law that when a measure simultaneously pursues a number of objectives or has several components that are indissolubly linked, without one being secondary and indirect in relation to the other, such an act will have to be founded on the various corresponding legal bases[42].

4 OBJECTIVES

4.1 General Objectives

The general objective of the exercise is to underpin EU policies that preserve, protect and improve the quality of the environment, pursue the prudent and rational utilisation of natural resources, strengthen the scientific and technological bases of Community industry, support the common transport policy, progressively establish an area of freedom, security and justice, increase fisheries productivity and support an open market with free competition.

These objectives are taken from those set out in the Treaty on European Union and the Treaty establishing the European Community[43]. They are not in order of importance but in reverse order to which they appear in the treaties. The general objective of this initiative thus highlights its cross-cutting nature. It integrates various sector policies.

4.2 Specific Objectives

We can distinguish three main aims:

1. to reduce operational costs and delays for those who use marine data and therefore:

    a) help private industry compete in the global economy and meet the challenge of sustainability;

    b) improve the quality of public decision-making at all levels. Coastal protection, impact assessments, maritime spatial planning, maritime surveillance, licensing and fisheries management are all heavily dependent on marine knowledge. Efficient implementation of the Marine Framework Strategy Directive[37] requires a working marine data infrastructure.

    c) strengthen marine scientific research;

2. to increase competition amongst users of marine data by providing wider access to quality-checked, rapidly-available coherent marine data and hence stimulate the development of new innovative services;

3. to reduce uncertainty in knowledge of the oceans and the seas and so provide a sounder basis for managing inevitable future changes.

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[41] C-42/97 *Parliament v Council* [1999] ECR I-869, paragraph 62.

[42] See Case C-178/03 *Commission v Parliament and Council* [2003], paragraphs 41-43 and 57.

[43] (consolidated text) Official Journal C 321E of 29 December 2006

4.3 Operational Objective

The specific objectives could be achieved by setting up and maintaining at an EU level:

1. a catalogue of European marine data collections with common formats and nomenclature complete with information including at least geographical location, time of measurement, ownership, precision and accuracy.

2. a set of complete interoperable layers for European sea basins, showing where data is being collected, where the gaps are and providing seamless quality-checked data layers (gridded or polygons) for unrestricted public access.

3. a user-driven process that determines priorities for the collection and assembly of marine data and that directs support to those activities that need to be carried out at an EU level in the most appropriate way.

4.4 Consistency with other EU policies and horizontal objectives

The objectives are consistent with other EU policies discussed in section 3.5.1 that have the broad aim of creating fair competition and non-discrimination between all potential users of public sector information.

Marginal cost charging (rather than cost-recovery) by Member States is encouraged in the preamble to the Public Sector Information Directive[28]

> *and Member States should encourage public sector bodies to make documents available at charges that do not exceed the marginal costs for reproducing and disseminating the documents*

They are consistent with the Commission's position on "scientific information in the digital age: access, dissemination and preservation"[44]

> *Initiatives leading to wider access to and dissemination of scientific information are necessary, especially with regard to journal articles and research data produced on the basis of public funding.*

They are consistent with other EU policies with a maritime dimension. The goal of the integrated maritime policy is to put into effect measures that contribute to the effectiveness of separate EU policies but that cannot be implemented through one policy alone. This is clearly reflected in the general objective which draws upon various Treaty articles. A better marine infrastructure will provide the underpinning data to manage and monitor the progress of the Common Fisheries Policy towards an ecosystem approach.

Achieving the objectives will help Member States jointly monitor the advance of their sea-basins towards good environmental status as required by the Marine Strategy Framework Directive[37]. Indeed the parameters selected for the chemical and biological components of the preparatory actions for ur-EMODnet were specifically

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[44] Brussels, 14.2.2007 COM(2007) 56 final

chosen to assess how much information is already available to set up the indicators that will be required for the Directive.

The objectives are consistent with the Lisbon Agenda. It is expected that the freer availability of data will encourage the growth of an innovative value-added sector tailoring the data for specific applications including assimilation into computer models and forecasts.

They are consistent with the sustainable development strategy. A better data infrastructure will allow a more precise assessment of the impact of proposed developments on the marine environment and will facilitate the monitoring of the sustainable development strategy itself.

They are consistent with the rights set out in the Charter of Fundamental Rights. Particularly relevant is freedom of expression - to receive and impart information and ideas without interference by public authority. A better marine data infrastructure will provide concerned communities the means to independently assess the state of their local seas and the impact of plans that might affect their well-being and livelihood.

5 POLICY OPTIONS

5.1 Possible Options

Before starting any new initiative to improve the marine data infrastructure, the following questions should be answered.

1. What activities should the EU support, in particular financially?

2. What is the most appropriate legal instrument?

3. How should any support be managed?

The aim is to look at the opportunity of EU actions and its potential costs; not to define the potential source of financing.

5.1.1 What should the EU do?

Turning marine data into knowledge and information requires three broad steps:

A. observation or collecting data- automatically through permanently moored or mobile instruments or through samples collected at sea and analysed in the laboratory. Observational data are usually stored by the data originator for their own use, or within specific programmes. Data may be transferred to a Data Centre for permanent archive, sometimes at national level.

B. assembling data from many sources so as to provide complete coherent, quality-checked data over wider sea areas such as marine basins, with ability to select and compare or combine different data parameters over the same area.

C. applying the data to compute statistics, make forecasts, assimilate and process through models, predict extreme values, or provide environmental indicators,- for instance of water quality, coastal erosion, fish population, or tsunami risk..

However it would be extremely hard to make a case for EU supporting data collection without knowing what is being collected already by national agencies where the gaps are and where the greatest user demand is. Neither would it be possible to develop indicators or added value products without assembling and processing the data that make up these indicators. We therefore consider three options for action:

1. ASSEMBLING the data to provide access to coherent, quality-checked, securely-maintained data over complete marine basins at marginal cost. The word 'assembling" should not imply a central database. Modern information technology allows the data to be distributed in a network but accessed through one gateway. Guaranteeing safe archiving for posterity is also included within this option.

2. COLLECTION - the same as option 1 but in addition supporting observation systems and the collection of data – automatically through permanently moored or mobile instruments or through samples collected at sea and analysed in the laboratory.

3. APPLICATION - the same as option 1 but also applying the data to provide indicators – for instance of environmental quality, coastal erosion, fish population or tsunami risk.

These are the three basic options for EU support. Options 2 and 3 are not mutually exclusive. Neither, either or both could be considered for action.

5.1.2 What is the most appropriate legal instrument?

Presently the European Union requires Member States to collect certain data under various regimes. Fisheries data is collected through a Council Regulation; some environmental data are collected through Council Directives. In addition some of the information can be used for other purposes than for the specific reason they are being collected while others cannot. The options are:

1. A Council Regulation

2. A Council Directive

3. A Council Decision

4. A Council Recommendation

5. A Commission Recommendation

These options can be combined, but should constitute a clear architecture. They should be assessed in particular in terms of the administrative burden.

5.1.3 How should this support be managed?

The word "Network" in the "European Marine Observation and Data Network" is deliberate. There has never been any intention to set up a colossal undertaking that takes on the burden of collecting, processing and applying all of Europe's marine data. Rather the aim has been to bind Europe's institutions together into a sustainable framework for the benefit of themselves and those who use the data. However the system requires an efficient decision making process at an EU level to decide what data is going to be collected and how it should be assembled and a secretariat to administer the process. The decision-making could be by Committee but the secretariat requires a small group of staff whose full-time job is to prepare meetings, managing contracts with the disciplinary assembly groups and sea-basin checkpoints, ensuring deadlines are met and prepare an annual report of activity. Options for the secretariat are:

1. carry on as before. Continue to support the marine data infrastructure in specific areas such as fisheries or space and through limited duration research projects or ah-hoc regulatory arrangements.

2. charge an existing institution - Joint Research Centre, European Environment Agency, ICES or EuroGOOS have been mentioned by stakeholders - to provide a secretariat that would prepare contracts for thematic assembly groups to manage a certain set of data – defined parameters over a defined sea-basin or set of sea-basins. These thematic assembly groups would be the principal nodes of the Network and would themselves communicate with the secondary nodes of the Network – national institutes

3. develop a new entity that would act in the same way as the previous option. This might fulfil the requirements for a European Research Infrastructure[45] or a European Grouping for Territorial Cooperation[46] or require a new status.

4. charge an organisation through a competitive call for the same tasks as the previous options.

Here the four options are mutually exclusive. The manner in which the tasks are carried: i.e. grants to organisations or procurement of services should be specified in the agreed work programme.

5.2 Discarded options

5.2.1 What should the EU do?

Error! Objects cannot be created from editing field codes.

Figure 2 Opinion from stakeholders as to which phases of data process chain the EU should be involved in.

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45 European Research Infrastructure Consortium (ERIC), Council Regulation (EC) N° 723/2009 of 25 June 2009

46 Regulation (EC) No 1082/2006 of the European Parliament and of the Council of 5 July 2006 on a European grouping of territorial cooperation (EGTC)

More than 95% of those consulted thought that the EU has a role to play in all the phases of turning data into knowledge – collecting, processing and applying – with some 60% "strongly" supporting such a role (Figure 2). However we have decided at this stage that the third phase - application of the data – is inappropriate for EMODnet. This is not because the EU does not have a role but rather because it is out of scope of this particular initiative.

The European Marine Observation and Data Network is part of the integrated maritime policy. The aim is to provide a basic infrastructure that benefits a variety of applications. Data archiving and provision in response to requests has the nature of a public good. Processing the data into customer-related applications products should usually be a commercial and competitive business, where SMEs obtain data from the best sources, merge and process for specialist use, and market competitively

Some of these applications will be on behalf of public authorities – local, national or European - who require the data for a particular purpose; to assess fish stocks, to forecast coastal erosion, to warn against tsunamis or to provide regional climate forecasts for instance. In these cases it is appropriate that the specific users of such data pay for the costs of the additional work to produce the required indicators or parameters. Thus, for instance, a civil protection budget ought to pay for tsunami warnings, with the appropriate authorities balancing precision against cost. This is not to say that these authorities would not benefit from EMODnet. By providing better access to the data on which the warnings are built, EMODnet lowers their cost. And by allowing universal access to data, it increases the number of providers able to deliver such a service. Increasing competition will drive down costs and improve the quality of service.

Another example of an information system that will benefit from EMODnet is the WISE-marine information system which is being specifically constructed to meet the regulatory requirements of the Marine Strategy Framework Directive[37].

Climate change might be a special case. One could argue that forecasts of future sea-level rise or ocean circulation are of such a wide benefit over all policies – transport, environment, energy – that the production and dissemination of integrated EU-approved parameters might be justified. However at this moment the confidence in single predictions is not high enough to warrant putting all our eggs into one basket. Here again competition drives progress. Confidence is increased by allowing different research teams to compare results of different methods. By facilitating access to quality-checked data, researchers will be able to calibrate and validate their individual models more easily, progressively reduce the uncertainties and converge on agreed solutions.

Finally we argue in this impact assessment that competition is enhanced if the organisation that collects and manages the data is not then automatically responsible for application of the data. Issues relevant to competition law could potentially arise if at a later stage specific EMODnet projects were classified as economic activities. Consequently EMODnet would be classified as an undertaking and competition law would apply It would not be appropriate if an initiative that aims to benefit competition could itself be accused of benefitting from a monopoly.

5.2.2 What is the most appropriate legal instrument?

Many observations have been made by national agencies in order to fulfil their own national policy objectives for national benefit. That is what their taxpayers expect. The question is, to what extent should national agencies conduct work to fulfil EU objectives, and using money that would otherwise be used for short-term national purposes? This concern applies, even when it can be shown that it is in the national interest to comply with the EU policy, since large benefits will result.

Thus the most important decision to be taken therefore is the sharing of the burden between the EU and national level; hence the distinction Regulation/Directive/Recommendation. The analysis will combine the Council and Commission Recommendation option, given that the decision as to whether this is done by the Council or Commission is of a secondary nature.

5.2.3 How should this support be managed?

A priori there is no reason to discard any of the options for administering the "Network" – carrying on as before, charging an existing institution with the job, or supporting a new entity.

6 ANALYSIS OF IMPACTS

In this assessment we distinguish primary impacts and derived impacts. The primary impacts are a direct result of achieving our operational objective and improving the marine data infrastructure. The derived impacts follow from the primary impacts. For instance an increase in competition, which is a primary impact, should result in better services and reduced cost to public authorities, which are derived impacts.

We shall aim to show the long-term impacts of an ideal marine spatial infrastructure. These long-term benefits justify the effort spent on investigating how such an infrastructure should be set up and what its cost will be. However ur-EMODnet will not only be useful in defining these parameters but will itself provide useful information to the marine community. These short-term benefits will be described separately.

We examine first the options as to what should be done. The "do nothing" scenario is described in section "3.5.4 The future". Basically we would continue to struggle with high operational costs, limited competition and high uncertainty in the ocean's future behaviour. Local national data needs would be partially satisfied by national agencies as in the past.

6.1 Primary impacts

The new policy for marine knowledge, however it is implemented, will have four primary impacts – the first three positive and corresponding to the specific objective of the programme and the fourth negative.

1. reduced operational costs and increased productivity for those who process and use marine data

2. greater competition for the application of marine data

3. reduced uncertainty on the state and circulation of the oceans and coastal seas

4. implementation costs for setting up and operating a new infrastructure

With careful attention to the design of the observing system at sea and the collection of data, the same system can provide data rapidly for commercial and short-term regulatory administration, as well as data types which are needed for climate change models and planetary models of biodiversity and sustainability. The first type of data and application provides a socio-economic benefit which pays off rapidly, with no uncertainty about discounting rates. The latter may ultimately be more important in the long run, but there is so much uncertainty both about the science, and the economic assumptions, that it is extremely difficult to quantify the benefit accurately. Both types of data and data processing are important.

The other economic, social and environmental impacts are a result of these four primary impacts and the magnitude of these impacts will depend on the particular options chosen.

6.1.1 Direct Operational Costs

Nearly all stakeholders – in research, public administration or industry - report that the current marine data infrastructure is not fit for purpose. It is therefore expected that any improvements will reduce their operational costs.

Option 1, "assembling", would lower these operational costs by reducing the labour involved in discovering and accessing data and then processing them so that the different components are interoperable. In section "3.4 Who is affected?" we estimate that the savings would be €100 million annually for scientists, €56 million for public authorities and €150 million for private companies. In those cases where the cost of data is an issue, the adoption of marginal cost rather than cost recovery will also reduce operational costs. It will also contribute to faster delivery. If a request for data can be met within a few days, it may be worth having. If it would take a few weeks, then the user may give up.

Option 2 "collection" will bring additional benefits to those sectors using the information. It might reduce the need for additional observations to meet the required precision.

These impacts are in the longer term. In the short term the ur-EMODnet being constructed will allow a better knowledge of the coverage of the present observation network. This will be of particular use for Member States in meeting obligations to the Marine Framework Strategy Directive. Article 11 indicates that "*Monitoring programmes shall be compatible within marine regions or subregions*". The parameters for the chemical and biological themes were chosen specifically to meet the needs of this Directive.

6.1.2 Competition

Making data more available will increase competition to deliver the value added products derived from the data. Option 1,"assembling", will increase competition

since those who collect data will no longer occupy a favoured position in delivering these products. Moving from a monopoly to a competitive market in general improves quality and allows innovation to flourish. Experience suggests that innovation flourishes if entrepreneurs are given the opportunity to compete on a level playing-field.

Thus better data will not only improve the efficiency of existing services but allow new services to develop. It is notoriously difficult to assess what these services will be. Nobody predicted the growth in text-messaging once cell-phone networks became established. Bill Gates was late in realising the significance of the internet[47]. Recently scientists searching for noise from incoming neutrinos in deep water discovered hitherto unknown activity of sperm whales in the Mediterranean[48]. There are a number of areas where new services might be expected. These could be:

1. business to government;

   Fisheries. Advice on stocks fished by several Member States is generally delivered by working groups made up of laboratories from these Member States – each bringing their own data. Assembling the data together beforehand would allow other operators to test and develop new methods for assessing stocks and providing advice.

2. or business to business;

   Bioprospecting. Greater knowledge of sediments, habitats and sea-floor topography will allow those searching for products such as enzymes or pharmaceuticals to target their exploration better.

   Tourism. An operator providing information on marine species distribution (eg. marine mammals) based on publicly available sources could provide services to the tourist industry;

   Energy. Forecasting peak wave conditions based on historic data would allow the offshore industry – both oil and renewable energy – to design structures with appropriate margins of safety to withstand these peak loads.

These increases in competition will accrue as the coverage and resolution of EMODnet improves. Even in its initial phases Ur-EMODnet will start to show where data are available under non-restrictive conditions and in these areas more private and public operators will find it easier to enter the market for the development of added value products.

Option 2 "collection" will not bring any significant competition benefits.

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47 Bill Gates – The Internet Tidal Wave. Microsoft, May 26, 1995. Made publicly available at United States Department of Justice

48 The neutrino and the whale. Nature Vol 462, 3 December 2009

6.1.3 Reduced uncertainty

The oceans and seas have a strong influence on human activities as described in section 3.1.4

A better measurement infrastructure will reduce uncertainty in the future behaviour of the oceans. This will allow more certainty by business and public authority in planning for the future.

According to a recent analysis[49] the three most vulnerable areas for sea-level rise in Europe in terms of potential economic damage are London, the Netherlands and Venice. The impact of uncertainty on costs has been studied in the framework of this assessment[10]. The study shows that whereas the London engineers consider a mean sea-level rise above 1 metre unlikely, the Dutch consider a range of 0.7-1.3 metres. Possibly memories of the catastrophic 1953 flood cause more caution. In the London case considerations of uncertainty have led engineers to reduce the target number (maximum water levels) from +4.2m to +2.7m and allowed the project team to discard the very expensive estuary barrage from the list of final options. This is an indication of uncertainty's role in cost. It is estimated that a further 25% reduction in uncertainty in sea-level rise would save public authorities (see section "3.1.4 Uncertainty")

By allowing those who estimate marine processes better access to data through option 1 "assembling", these uncertainties will be reduced.

However more data is clearly needed, particularly near the coast. In a recent book concerning uncertainty in environmental predictions[50].

> *Accurate prediction of future sea-level change is clearly impossible but predicting the direction and the general magnitude of changes in the level of the sea is within the realm of our capabilities (...) The logical next step should be to turn towards a more data-rich, qualitive (sic) modelling and to seek answers of a more general nature, to seek likely trends for the future, to example all the possible scenarios, the worst and best cases. It would make sense to spend a higher proportion of effort and money to gather field data to answer the many remaining basic questions about the future of the atmosphere and ocean.*

Biogeochemical sampling in the coastal seas is well below optimum, and still very difficult. What has become apparent in the last few decades is that many processes are much more "spiky" and variable than we used to think, with peaks and troughs both in time and space. Thus measurement schemes which we used to think were describing the "average" conditions are anything but. Emerging projects such as Smart Buoys (time variability) and Ferry Box (space variability) are beginning to fill the gaps, but only beginning.

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[49] Policy Research Corporation Final report to the European Commission (2009) "The economics of climate change adaptation in EU coastal areas"

[50] OH Pilky and L Pilkey-Jarvis, 2007 "Useless Arithmetic: Why Environmental Scientists Can't Predict the Future", Columbia University Press, ISBN 978-0-231-13212-I

Option 2 "collection", if properly targeted, will therefore show additional benefits over and above option 1 "assembling".

These reductions in uncertainty will progressively increase as EMODnet develops. The first phase, ur-EMODnet, will play a significant role because it will provide a better indication of what the uncertainty is at present.

6.1.4 Implementation costs

6.1.4.1 Option 1 Assembling

The preparatory actions of ur-EMODnet currently underway are summarized in Table 2 which shows how much is being spent by the Commission now and how far away from a fully-developed infrastructural system it is.

Table 2 Current expenditure on marine data infrastructure

	Preparatory actions 2008 budget	percentage of basins covered	percentage of parameters covered	Refinement of resolution needed
bathymetry	€975,000	40%	50%	X10
geology	€925,000	30%	100%	X10
chemistry	€700,000	25%	20%	1
biology	€850,000	20%	5%	1
Total	**€3,450,000**			

We will use this as at basis to estimate the total cost of moving from the prototype ur-EMODnet to a more operational EMODnet. These actions have only recently started so there are wide margins of uncertainty in these numbers. However we can make an approximation. We assume that the cost can be estimated by:

1. Assuming that 40% of the present cost is overhead and methods development and 60% is the assembly and processing of data.

2. Extrapolating to full coverage of the 10 European sub-basins defined in the Marine Framework Strategy Directive and assuming that covering each sea-basin costs the same.

3. Extrapolating to a full range of parameters. This assumes that we obtain roughness as well as water depth for the hydrographic layers and that we assemble a fuller range of chemical compounds and biological species.

4. Refining the resolution for the hydrographic layers to 50 metres and for the geological lot to 1:100,000. Although the amount of data increases quadratically with resolution, we assume that the cost increases linearly.

5. Assembling fisheries data is facilitated by work done already under the Data Collection Framework on nomenclature standards and aggregation levels. Human activity is open-ended but we can assume that obtaining information on the main activities that have an impact on the marine environment – gravel extraction, petroleum exploration, aquaculture – will require some thought in order to arrive at mutually compatible data across the Member States. Some work on assembling

physical data has already been done within EU research projects. Scaling these up for European coverage results in a figure of €10 million.

Moving from the baseline in Table 2 to the fully operational system, our estimate for the completion of all the data layers for an operational EMODnet with complete coverage of European sea-basins, a higher resolution and a better coverage of parameters is summarised in Table 3

Table 3 First Estimate of cost of setting up marine data infrastructure

	Preparatory actions 2008 budget	**percentage of basins covered**	**percentage of parameters covered**	**Refinement of resolution needed**	**complete coverage**
hydrography	€975,000	40%	50%	10	€29,250,000
geology	€925,000	30%	100%	10	€18,500,000
chemistry	€700,000	25%	20%	1	€8,400,000
biology	€850,000	20%	5%	1	€51,000,000
Sub-total	€3,450,000				€107,150,000
fisheries					€2,000,000
physics					€20,000,000
Human activity					€4,000,000
Total					**€133,150,000**

We then arrive at a figure of nearly €133 million to set up the complete infrastructure. If we were to limit ourselves to completing the geographical coverage with the current resolution and parameters only, the amount required would be €10 million. If we increase the percentage of parameters and complete geographical coverage without the increase in resolution the total amount would be €60 million. This last figure is dominated by the biological component where the discussion of an ideal set of parameters is least advanced.

We have to add to this the cost of running a secretariat, quality control and priority setting and the cost of maintaining the data. Quality control would be additional to that implemented by those setting up the infrastructure and be implemented at a sea-basin level. It would ensure compatibility between the different thematic layers. Priority setting would also be implemented at the sea-basin level and include analysis of user feedback. Maintenance includes the addition of data from new surveys and the regular updating of physical, chemical and biological data layers from monitoring programmes. This cost would rise as the coverage and resolution of the data layers increases. Assuming a ten year programme[51], an annual sum of €18 million is required for the first five years, €20 million for the next five years and €11 million subsequently as indicated in Table 4.

[51] This is assumed to start in 2011 and finish in 2020 in line with the Commission's "EU 2002"objectives .

Table 4 First estimates of annual costs of a programme aiming to achieve fully operational infrastructure for assembling data in 10 years.

	First five years	**Second Five Years**	**Thereafter**
Implementation	€13,000,000	€13,000,000	
sea-basin quality control and priority setting	€2,000,000	€2,000,000	€2,000,000
maintenance and updating	€2,000,000	€4,000,000	€8,000,000
secretariat	€1,000,000	€1,000,000	€1,000,000
Total	€18,000,000	€20,000,000	€11,000,000

The present impact assessment however suggests however that the programme will be preceded by a more modest extension of ur-EMODnet that will further clarify the steps involved in setting up the operational infrastructure. This extension will focus on completing coverage at a low resolution, investigating types of data that have not been assembled so far (physics and human activity) and maintaining the layers that have already been produced. The average annual cost for a three-year programme is estimated at €7,500,000. More details are provided in section 7.1.7 "Interim Period 2011-2013"

These costs would be offset to some extent by a reduction in funding from the Community's research budget for projects aiming to show the feasibility of a marine data infrastructure[52]. The methods and technologies have now been validated and it is time to move towards an operational service.

6.1.4.2 Option 2 Collecting

The EU already spends about €45 million per year to support fisheries data collection and on average €110 million[53] per year over the Seventh Framework Programme to support space measurements through the GMES initiative.

The cost of option 2 "collection" depend on the ambition.

1. The Euro-Argo consortium believe[54] that €3 million per year from the EU would support the European component (€8 million per year) of a world wide in situ global ocean observing system, based on autonomous profiling floats.

2. The Continuous Plankton Recorder Survey's marine monitoring programme has been collecting data from the North Atlantic and the North Sea on the ecology and biogeography of plankton since 1931 and costs about €1.8 million per year.

3. It has been estimated[55] that developing a complete multibeam sonar mapping of EU Member States' waters would cost about €100 million for the deep water and more than ten times that for the shallower continental shelf. And thus this effort distributed over 20 years would cost approximately €50 million per year.

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52 SEADATANET etc

53 It can be assumed that about 40% is for sea and ocean observation (DG ENTR private communication).

54 Presentation to Commission services 24 April 2009

55 Phil weaver, National Oceanography Centre, Southampton "A map of the European seabed" presentation at European Marine Observation Expert Group, 18 June 2009

4. Establishing a European Multidisciplinary Seafloor Observatory for long-term real-time monitoring of geosphere/biosphere/hydrosphere interactions based on 8 sites would cost about €240 million with operational costs of €32 million per year. Error margins on these costs are ±20%[56].

This list is not exhaustive.

6.1.4.3 Comparing the Options

Option 1 can be implemented relatively cheaply at about 1.5% of the current total cost of marine data collection in the EU. It will produce a multiplier effect on benefits from the observations collected. Later investment in further observations, as in option 2, can benefit from better information as to where further data can produce the most added value.

6.2 Derived impacts

We can then map out how these primary impacts influence the economic, social and environmental impacts listed in the impact assessment guidelines[57].

6.2.1 Economic Impacts

6.2.1.1 Functioning of internal market

Greater competition for value-added services based on marine data will lead to improved movement of services and an increase in choice for these services.

Therefore option 1 "assembling" will have a high impact on functioning of the internal market. Option 2 "collection" will bring additional benefit to targeted sectors (public and/or private).

6.2.1.2 Competitiveness, trade and investment flows

Innovation is mainly driven by entrepreneurs[58]. Experience suggests that the best way to promote innovation is to set up the appropriate market conditions rather than trying to forecast and bet on winners.

The reduced operational costs on firms relying on marine data will increase productivity and render them more competitive. It is difficult at this stage to estimate what new services will develop on the back of these newly available data but the example of the United States, where public information and copyright laws are geared towards open access, suggests that a number of innovative added-value services will develop to fill market needs.

Therefore option 1 "assembling" will have an impact on the competitiveness of those firms in proportion to the relative share of that firm's costs that are devoted to processing of marine data.

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56 Estimate from the Preparatory Phase project (EMSO), in collaboration with ESONET:

57 Impact assessment Guidelines, 15 January 2009, SEC(2009) 92

58 Reviewing Community innovation policy in a changing world Brussels, 2.9.2009 COM(2009) 442 final

Option 2 "collection" will bring additional but unknown benefits.

6.2.1.3 Operating costs and conduct of business/ small and medium enterprise

The benefit to business will come first from the direct reduction of operating cost (primary impact 1) and secondly through the reduction in uncertainty on the state of the ocean (primary impact 3).

Operating cost

Operating costs will reduce for those businesses where marine data is an essential input; not necessarily because the direct costs of data purchase will change, but rather because less labour will be required for finding, assembling and processing the data quickly. In essence there will be economies of scale by centralising assembly and a reduced risk of free-riders behaviour.

A study[59] has estimated that the value of implementing an "integrated" (as opposed to "fragmented") ocean observing system would be hundreds of millions of dollars per year to the United States. The United States GDP is of a similar magnitude to that of the European Union.

Reduction in Uncertainty

A reduction in uncertainty will also have a direct impact.

1. Firstly on those industries that exploit the resources of the sea. A Price Waterhouse Cooper study[60] suggests that an expenditure of €70 million on marine mapping in Irish waters would result in benefits of €415 million to the fisheries, aquaculture, biodiversity (seaweed was used as a proxy), renewable energy, energy exploration and aggregate industries– a return of a factor of six.

2. Public authorities charged with coastal management will benefit from €100 million for a 25% reduction in sea-level rise uncertainty as described in section 5.2.1.5

3. However even terrestrial industries would benefit. The benefits to the energy and agriculture industries of better seasonal forecasts would be very large indeed. It has been estimated[61] that the benefits of modest improvements in predicting El Niño would be of the order of $240 million annually for the US agriculture industry which is similar in volume to that of the EU. Better marine observations are not a sufficient condition for more accurate seasonal forecasting but they are a necessary one.

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59 Hauke Kite-Powell;Charles Colgan; Rodney Weiher Estimating the Economic Benefits of Regional Ocean Observing Systems Coastal Management, Volume 36, Issue 2 March 2008 , pages 125 - 145

60 Price Waterhouse Cooper, INFOMAR Marine Mapping Survey Options Appraisal Report June 2008

61 Andrew R. Solow, et al., "The Value of Improved ENSO Prediction to U.S. Agriculture," Climate Change, Vol. 39, 1998, pp 47-60.

The two options

Option 1 "assembling" will therefore have a high impact on the direct operating cost. More data collection "option 2" will have an additional impact on reducing the uncertainty and hence the overall operating cost.

6.2.1.4 Administrative burdens on business

It is not intended that there should be any new obligations on business. Any new measures will be aimed at public bodies. Neither option has an impact.

6.2.1.5 Public Authorities

Benefits

Public authorities will be affected by all primary impacts. They will benefit from reduced operational costs, lower prices for services through increased competition and greater certainty in the future behaviour of the sea.

A good example is the construction of sea defences. Currently these have to take into account not only local conditions but also future global rises in sea-level. Since this is not known with any precision, engineers have to be conservative and often over-dimension projects. This raises costs.

Public authorities at an EU and national level would be responsible for the implementation costs of setting up and operating this infrastructure.

Costs

Given the foreseeable budget constraints, the fact that public services might have to deliver the same or better levels of service with fewer resources must become a powerful engine for innovation[58]. With an operational EMODnet, those authorities that are currently engaged in monitoring activities will be able to see their own activity in a sea-basin perspective and plan their own monitoring activities more effectively.

Additional costs to national public authorities caused by EMODnet alone will be small. Up to now the preparatory actions for EMODnet have been paid through procurements from the EU budget which gives the EU the rights to distribute the assembled data. The EU supports 50% of the costs of data collection in fisheries through grants. This mix of measures - paying 100% of the costs of assembly (option 1) and 50% of the costs of collection (option 2) - would seem appropriate for an operational EMODnet.

For option 1, "assembly", the main cost to authorities would then be the process of adopting common standards and improving access to national databases. However Member States, partly as a result of the INSPIRE Directive and partly as good management practice, are doing this anyway. EMODnet would not bring additional obligations.

Should the data collection component of option 2 be implemented through 50% grants then there would be costs to national authorities. But these would be

voluntary. Authorities that did not wish to apply for grants would not be compelled to do so.

There may be some loss of income to public bodies (not necessarily public *authorities*) providing data for a fee (see section 6.2.1.5). This will not be income from raw data; in section 7.4.2 we show that this is negligible. However these bodies may lose out to other public or private concerns if they no longer enjoy a monopoly in selling the added-value products. The replacement of one operator by another that can deliver the same product cheaper or of better quality is not, of course, a loss to the economy as a whole. This position is consistent with other EU legislation. Access to raw data on comparable terms for all users of public data is the objective of the Public Information Directive[28]. Regulators in the United Kingdom and Sweden have pointed out that this is not always the case at present[19].

Therefore option 1 "assembling" has a significant benefit for public authorities and option 2 "collection" could offer an even greater benefit. Costs would be less then the benefits.

6.2.1.6 Property Rights

Property rights will be affected by option 1 in three ways.

1. better acknowledgement of ownership of marine data. All data should be accompanied by a description of their ownership and this ownership should be recognised when the data are used. The feedback will help in making a case for continuing monitoring. This recognition would be a positive impact for the data-owner.

2. a standardisation of intellectual property for marine data at a European level which would encourage the free movement of services in the internal market.

3. reduced control of how data is used. Owners of data submitted to the European Marine Observation and Data Network would retain ownership but would not be able to dictate how the data should be used[62]. From the point of view of the data owner this might be seen as a negative impact.

A citation mechanism could help scientists who devote their career to collecting data at sea. Their contribution to research could then be assessed on the number of times their data is used. This would be analogous to the way scientists' published articles are assessed by the number of times they are cited by other scientists.

Option 2 "collection" would have no impacts over and above those already included in implementation option 1 "assembling"

6.2.1.7 Innovation and research

Reduced operational costs and greater competition will stimulate research.

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62 Although they might stipulate that it must not be used for safety-critical tasks (eg bathymetry for safe navigation) in order to avoid liability

1. Better access to marine data will stimulate innovation and research. In the same way that public authorities and the private sector, the research community will improve productivity through reduced operating costs for finding and assembling data. Researchers will be able to put the data that they themselves collect in the context of data from elsewhere and other disciplines.

2. If a researcher has sole access to data there is less incentive to publish quickly. Competition may therefore speed up publication.

In section "3.4.1 Science" we calculate an increase in scientific productivity worth €100 million per year. I addition this will lead to greater confidence in research findings and deeper insights in the functioning of the ocean.

Option 1, "assembling", would therefore have a significant impact on the quality of research.

Option 2 "collection" would certainly have an additional impact; the magnitude of this additional impact would depend on how much extra data is collected.

6.2.1.8 Specific regions or sectors

In the short-term it will largely be the coastal region that benefit from this initiative. Many of the enterprises, public authorities and research bodies that replied to the questionnaire are situated on the coast.

In the longer term regions further inland will benefit. The influence of climate changes, biodiversity, marine renewable energies, sustainable aquaculture all reach beyond the coast.

This is valid for both options.

6.2.1.9 Third countries and international relations

There are a number of international initiatives to share information on earth observation and monitoring in order to avoid duplication and create a more joined-up system. Notable amongst these is the Global Earth Observation System of Systems, or GEOSS, which is a response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialized countries. Creating a better marine data infrastructure at a European level will contribute towards the aims of GEOSS.

6.2.1.10 Macro-economic development

The expected growth in the value-added sector discussed in 6.2.1.2, should promote employment and growth in the medium term. Furthermore a better marine data infrastructure can support emerging industries such as marine biotechnology.

In the short to medium term these benefits would derive mainly from option 1 "assembling".

6.2.2 Social Impacts

6.2.2.1 Employment and labour markets

For the reasons described in 6.2.1.2, 6.2.1.3 and 6.2.1.10, growth is expected in sectors that build on the marine data infrastructure to create jobs. These would largely be in the private sector.

The greatest benefit would be from option 1 "assembling" although some additional benefit would derive from "option 2". More effort on observation and data collection will increase employment in the private sector because this work tends to be subcontracted. It will also provide an impetus to the high technology sensor industry.

6.2.2.2 Individual, private and family life, personal data

Personal data may be an issue in two specific cases:

1. acknowledgments of data ownership might include the names of those responsible for collecting and processing data. This implementation must meet the requirements of Data Protection Directive 95/46/EC

2. some human activity data – such as fishing vessel positions – might be considered as personal data and cannot be published indiscriminately. In these cases the data should be aggregated such that individuals cannot be identified.

These impacts can be managed through careful framing of the legislation.

6.2.2.3 Governance, participation, good administration, access to justice and ethics

Better access to coherent marine data will improve participation in governance. This will be particularly the case at a local level when plans for coastal development are presented. Local communities will be able to independently assess impacts or challenge assertions.

Access is taken care of with option 1. Option 2 would not bring additional benefits.

6.2.3 Environmental Impacts

The proposal itself will not alter the environmental impact of data collection and processing. It is not proposed to change the number of research vessels. However it will have a large impact on the EU's efforts to mitigate and adapt to climate change and protect biodiversity.

6.2.3.1 The climate

As pointed out in section 6.2.1.3, reduced uncertainty in climate change can help authorities plan their adaptation strategies more effectively. Whilst it is certain that average global temperatures are going to rise, there is no agreement at all as to what this is going to mean in terms of regional temperatures and precipitation or global sea-level rise. Without this regional understanding there can be no planning of adaptation strategies. And since oceanic behaviour drives the local climate, there can

be no understanding of future regional climates without proper understanding of the oceans.

Contributing to a better understanding of ocean circulation may be the single greatest contribution that the EU can make in helping Europe adapt to climate change.

Option 1 "assembling" would contribute to this understanding. Option 2 "collection", will bring additional benefits

6.2.3.2 Biodiversity, flora, fauna and landscapes

Protection of marine biodiversity, flora, fauna and landscapes requires measures such as fisheries management plans, networks of marine protected areas and environmental impact assessments. Confidence in the effectiveness of these measures can only be guaranteed if the data infrastructure on which they are based is sound. And since many of these measures require information from waters of more than one Member State this infrastructure requires cross-border interoperability. An effective European marine data infrastructure will therefore contribute towards effective planning to protect biodiversity, flora, fauna and landscapes.

Option 1 "assembling" would help.

However really we need more observations[63].

> *Direct scientific sampling of the seabed on the ocean margin covers at the most only a few tens of km^2, depending on the type of technology used, and the density of coring of the seabed is inadequate in most regions to describe biological communities (...) The discrepancy between available scientific information and the level of commercial exploitation presents a severe challenge to the development of environmental management plans. How do we plan the sustainable development of the European [Atlantic] margin from Spain to Norway based on knowledge gained from an area the size of a few football fields?*

Option 2 "collection" would certainly increase the effectiveness of marine management.

6.2.3.3 Renewable or non-renewable resources

Difficulties in siting windfarms onshore due to concerns from local residents about impacts on the landscapes is leading to increased attention to their deployment offshore. The UK is considering the implications of constructing 25GW capacity[64], which is the equivalent of about 20 nuclear power stations, by 2020. A better marine data infrastructure will help site these farms most efficiently to maximise their effectiveness and minimise their environmental impact.

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63 Rogers, A. et al. "Life at the edge: achieving prediction from environmental variability and biological variety. In "*Ocean Margin Systems*", Wefer, et al. (Eds.), Springer Verlag, pp 387-404.

64 UK Department of Energy and Climate Change, Offshore Energy SEA Environmental Report, January 2009

If option 2, "collecting", included a more detailed mapping of the sea-bed then additional benefits could accrue.

6.2.4 External Impacts

Since the information provided through EMODnet is publicly available. The economic, social and environmental impacts described above are equally relevant to the EU partners in accession countries, countries benefitting from the European Neighbourhood Policy and our wider international partners. Hence co-operation with these partners can be sought.

The impact of ocean acidification or sea-level rise will largely be felt in the developing world. Acidification threatens those whose livelihoods depend on healthy coral reefs and it is generally accepted that the primary group threatened by sea-level rise are those in low-lying islands and deltas. Greater certainty in these impacts would help target development policies.

Option 1 "assembling" would contribute to reducing these uncertainties. Option 2 "collection", would bring additional benefits.

7 COMPARING THE OPTIONS

So far we have examined the impact of an improvement of the marine data infrastructure in general terms. In this section we aim to clarify how the different options would affect that impact.

7.1 What should the EU do?

7.1.1 Stakeholder opinion

We have distinguished three different phases in the observation process – collecting data, assembling and processing the data and applying the data.

More than 90% of those consulted agreed that the EU had a role to in all phases of the process with about 60% strongly agreeing. This was a universal opinion; there was no substantial difference between the views of the different stakeholder groups – industry, authorities and research (Figure 2).

However some from the research community commented that the Commission's roadmap focused too much on assembling and processing existing data when it is already clear that the existing marine observation network is inadequate. For instance a researcher from a German public research commented:

> *The main focus of the roadmap is on existing data (availability, quality etc.). However, there is a strong need for new European observation networks to be completed and build. Especially near-real-time observation platforms with model support (data assimilation) need to be build and continuously operated.*

7.1.2 Impacts

A quantitative comparison of impacts can be dangerous because numbers can be taken out of context. Nevertheless it can provide an indication of the relative magnitude of the costs and benefits and of the factors that have the most influence.

Based on the United States estimate of the opportunity cost of relying on a fragmented rather than an integrated marine observation infrastructure[20] and on our own estimates of the cost of using marine data in Europe (section "3.4 Who is affected?") we can estimate that a reduction in operational costs for users is worth €300 million. Option 1 "supporting the processing and assembly of marine data" will have the greatest impact. Option 2, "supporting more observations and monitoring" will have little additional impact.

It is likewise hard to estimate the benefit that increased competition will bring. An old but still valid study[65] in 2000 on behalf of the European Commission's Directorate General for Information Society concluded that less restrictive practices in the United States explained the greater size (by at least a factor of six) and vibrancy of industries relying on public sector information. Even taking a pessimistic assumption that the value of this sector today is tiny – between €10 million and €30 million annually, we arrive at a potential annual benefit of between €60 million and €200 million. Increased competition will follow implementation of option 1. Option 2 will have little additional impact.

If we assume that a better monitoring infrastructure results in a 25% reduction in uncertainty in sea-level rise, then €100 million of direct savings in coastal defence infrastructure are likely. Better seasonal forecasts and better fish stock assessments will also result in even greater savings but more work is necessary to determine whether better data alone can deliver these benefits. We shall cautiously claim €20 million a year for these but the potential benefits may turn out to be much larger. If option 2 includes more detailed surveys of seas-beds, then the Irish study[60] suggests that the resulting reduction in uncertainty results in a six-fold payback on the investment. We shall be modest and assume a factor of two.

The costs of option 1 depend on the target resolution and the timescale. The analysis of section 6.1.4 suggests an annual cost of €18 million for 10 years followed by €10 million thereafter. Option 2 would cost another €10 million for focused support to present monitoring programmes and €60 million per year for 20 years if a European sea-bed map were to be produced,

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65 Commercial exploitation of Europe's public sector information Pira International Ltd., University of East Anglia and KnowledgeView Ltd., 20 September 2000

Table 5 comparison of options for primary impact. The benefits will accrue once the full EMODnet has been implemented .During the development phase they will be smaller. All costs and benefits are expressed as annual figures

IMPACT	Cost or benefit	Option 1 support data processing and assembly (annual)	Option 2 support data collection (additional to option 1)
Reduced operational costs	benefit	€300 million	
Increased competition	benefit	€60 million - €200 million	
Reduced uncertainty	benefit		€220 million
Increased implementation costs	Cost	€20 million[66]	€10million-€90million

7.1.3 Economic impacts

The primary impacts translate into economic, social and environmental impacts as follows

Table 6 comparison of options for economic, social and environmental impacts

IMPACT	option 1 support data processing and assembly	option 2 support data collection (additional to benefits of option 1)
ECONOMIC IMPACTS		
Functioning of internal market	+++	
Competitiveness, trade and investment flows	+++	+
Operating costs and conduct of business/ small and medium enterprise	+++	+
Administrative burdens on business	no	no
Public Authorities	+++	++
Property Rights	±	no
Innovation and research	+++	+++
Specific regions or sectors	coastal	coastal
Third countries and international relations	++	++

[66] Assuming a 10 year programme to constuct an EMODNET with resolution 10 times finer than the present ur-EMODNET.

IMPACT	option 1 support data processing and assembly	option 2 support data collection (additional to benefits of option 1)
Macro-economic development	++	++
SOCIAL IMPACTS		
Employment and labour markets	in private sector	mostly in public sector
Individual, private and family life, personal data	Data protection should be considered in legislation	
Governance, participation, good administration, access to justice and ethics	+++	+
Social impacts in third countries	++	++
ENVIRONMENTAL IMPACTS		
The climate	++	+++
Biodiversity, flora, fauna and landscapes	+	+++
Renewable or non-renewable resources	++	+

7.1.4 Subsidiarity

The main justification for action at an EU level is the transnational nature of the challenge. Assembling sea-basin and pan-European-sea pictures requires a collaboration across borders and across disciplines. Experience so far demonstrates that the collection and sharing of data across sectors and across Member States does not take place adequately, efficiently or rapidly. Unless the European Union takes or facilitates actions in this field it is unlikely to happen. The results from the discussions in the Expert Group and the replies to the consultation corroborate this thesis. 67% of those consulted strongly agreed that "without sustainable support from the EU it will be extremely difficult to build up a sustainable European infrastructure. Another 24% tended to agree. Less than 3% disagreed.

The transnational nature of the issue provides a strong justification for action at an EU level. This is clearly valid for option 1 "assembly".

For option 2` "collecting data" the issue is more complex. Member States already collect much data and in some cases are legally obliged to collect data from them. For instance the Marine Strategy Framework Directive[67] obliges Member States to "*establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of their marine waters*." Any EU support

[67] Directive 2008/56/EC

should not discourage Member States from fulfilling their moral or legal obligations. However there are precedents:

1. The EU already supports the collection of fisheries data. This is a unique example because the data is required to support management decisions and fisheries is an area where the EU has exclusive competence.

2. The EU also supports monitoring from space. The needs of Member States are almost identical and the satellite orbits can cover the whole globe. The advantages of a shared infrastructure are obvious.

The subsidiarity case for option 2 is strongest when the additional monitoring is to take place outside Member States waters. However this is not a necessary condition. To misquote John Donne "No island is entire unto itself[68]". Marine observations do not only benefit the State in whose waters the observations are made.

7.1.5 Proportionality

The principle of proportionality states that any Community action should not go beyond what is necessary to achieve satisfactorily the objectives which have been set. Community action should be as simple as possible and leave as much scope for national decision as possible, and should respect well established national arrangements and legal systems.

For both options the EU actions would add value to what Member States are already doing with additional resources of between 1.5 and 8% of what Member States are spending already. These resources would enable the Member States to achieve their objectives more effectively and are thus commensurate.

The aim is that the initiative should build on what Member States are already doing. Indeed this is one of the fundamental principles of the roadmap and one that was largely accepted by the stakeholders in the consultation with a total of 85% agreeing and 50% strongly agreeing.

7.1.6 Conclusion

This analysis suggests that option 1 "assembling" would have a considerable and proportionate economic, environmental and social impact.

Option 2 "collection" has the potential to deliver significant additional benefit, particularly in reducing uncertainties in ocean behaviour with all the knock-on benefits that this brings. However more work needs to be done in identifying precisely what extra observations need to be made and how much they would cost. In some areas, for instance the EuroArgo floats (see section 6.1.4) a convincing case has been made that a relatively modest level of EU support (€3 million annually) would bring significant benefits for the whole EU. However in other areas this analysis can only be made once option 1, "assembling", has been implemented. It is expected that some insights will be forthcoming as the preparatory actions begin to deliver results from 2010 onwards.

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[68] John Donne, Meditations XVII, 1624

The proposal then is to adopt a two phase approach. The first phase, 2011-2013, would focus only on assembling data. During 2011 there would be an interim evaluation of the results of the preparatory actions and an ex-post evaluation in 2013. These results would feed into an impact assessment in 2013 that would clarify which options to pursue from then onwards – only assembly or assembly and collection.

7.1.7 Interim Period 2011-2013

Based on the knowledge of the current knowledge of the current data infrastructure obtained through stakeholder consultations, the first six months of the preparatory action projects and advice from the Marine Observation and Data Expert Group, a number of actions to support data assembly could be contemplated in the period 2011-2013. As marine knowledge increases, some of these priorities might change, but provided adequate financial support is available, the following activities will be undertaken.

3. completing the coverage of the geological layer in ur-EMODnet to cover all European sea-basins at a one to one million scale.

4. preparing finer resolution gridded bathymetry data. It is likely that the current preparatory actions will confirm that there are no technical obstacles to the production of finer resolution data layers. They will also show where there is enough available survey data for the construction of these layers. These data were the most highly sought-after in the stakeholder survey. The aim would be to produce gridded layers at 50 or 100 metres resolution for at least one sea-basin.

5. preparing layers for physical data. Now that the boundaries of the GMES initiative is becoming clearer, an action to assemble data from measuring stations and buoys on significant wave height, salinity, sea level, and currents will be undertaken. This will be the first ur-EMODnet action where the aim will be to deliver near-real time information – both directly to users and to whatever prototype GMES marine core service is underway. Local authorities responsible for coastal protection have indicated the need for long-time series and this will be taken care of as well.

6. strengthening the biological and chemical layers. It is premature to speculate whether this will be done through increasing the number of species dealt with or the number of sea-basins covered. Or both. A decision will be made in 2011 after the mid-term evaluation of the existing projects.

7. developing a thematic assembly group for human activity data – shipping lanes, pipelines, gravel extraction etc

8. maintaining the metadata catalogues and data layers being established in ur-EMODnet and setting up a process whereby new information can be incorporated into them

9. setting up one or more prototype sea-basin checkpoint. Up to now "thematic assembly groups"[69] in ur-EMODnet have assembled data of one class – eg biology, or chemistry. The aim with these sea-basin checkpoints is to collect stakeholders round a sea-basin to consider all the data available, including that which has been assembled through EU initiatives such as ur-EMODNET, GMES, the Data Collection Framework, to assess whether the different efforts are interoperable, to analyse where the gaps are and to determine where the priorities are for further data collection and assembly.

10. setting up a prototype secretariat to prepare meetings, manage contracts with the disciplinary assembly groups and sea-basin checkpoints, ensuring deadlines are met and preparing an annual report of activity.

Table 7 Average annual expenditure for setting up ur-EMODnet (3-year programme)

Updating of geological, chemical and biological data layers	€2,000,000
Creation of physical and human activity layers	€1,500,000
Creation of high resolution bathymetry layers	€2,300,000
Sea-basin checkpoints	€700,000
Secretariat	€500,000
Maintenance of existing layers	€500,000
total	€7,500,000

Table 7 gives an indicative level of funding that would be required. Undertaking these actions would provide a better basis for taking a decision on a full-scale operational EMODnet.

7.1.8 Afterwards

Section "6.1.4 Implementation costs" provides a breakdown of a 10-year programme to set up a properly integrated marine data infrastructure. It is intended that the priorities for afterwards be identified by stakeholders at a sea-basin level once a clearer picture of what is already being collected has been drawn. However developing finer resolution sea-bottom maps and ensuring a high-quality baseline for monitoring climate change are expected to have some priority.

7.2 What is the appropriate legal instrument?

Article 249 of the EC Treaty defines the instruments which the institutions can deploy in order to carry out their tasks:

> *"in order to carry out their task and in accordance with the provisions of this Treaty, the European Parliament acting jointly with the Council, the Council and the Commission shall make regulations and issue directives, take decisions, make recommendations or deliver opinions."*

Article 249 of the EC Treaty states that "*recommendations and opinions shall have no binding force*". These are "generally adopted by the institutions of the Community

[69] This term will be introduced in the Communication on marine knowledge and refers to a consortium charged with assembling data and metadata of a certain type. Each ur-EMODNET preparatory action is a prototype thematic assembly group.

when they do not have the power under the Treaty to adopt binding measures or when they consider that it is not appropriate to adopt more mandatory rules" and can assist in interpreting legislation[70]. We have argued that the Community does have the power to adopt binding measures. Furthermore defining the appropriate roles for bodies of the Network will require the definition of mandatory roles. So recommendations and opinions are not appropriate.

The EMODnet objectives can be met in two ways – obliging the Member States to strengthen their data infrastructure or enabling them to do so. As indicated in section 3.5.1 the EU has largely already gone as far as it can via obligatory elements to be implemented at Member State level, such as the INSPIRE Directive[26] the Environmental Information Directive[27]and the Public Sector Information Directive[28]. Thus although any EMODnet legislation might include an element of obligation it is more likely to be an enabling measure.

Article 249 of the EC Treaty states that "*a Directive shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods."*

.INSPIRE is a Directive and EMODnet standards will be built on INSPIRE

Article 249 of the EC Treaty states that "*a regulation shall have general application*" and "*shall be binding in its entirety and directly applicable in all Member States*." A regulation's general application means that it is "*applicable to objectively determined situations and involves legal consequences for categories of persons viewed in a general and abstract manner*"[71].

Obligatory measures can either be imposed through Regulations or Directives. However, in the case of enabling measures defining expenditure programmes or independent agencies at European level a Regulation is more appropriate. A Regulation was chosen for the GMES proposal. EIONET[72] and LIFE[73] were implemented through Regulations. If this option is chosen, the Commission could modify an existing legislation or propose new legislation.

A Council Decision can also be used to provide a framework within which the Commission can work towards producing implementing measures For instance, a "*Sui Generis*" decision was used for IDABC, as the Commission was to establish a rolling programme for the whole duration of the Decision for the implementation of projects of common interest and horizontal measures[74].

7.3 How should this support be managed?

We have identified four options:

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70 Case C-322/88 *Grimaldi* [1989] ECR 4407, paras 13, 16 and 18.

71 Case C-6/68 *Zuckerfabrik Watenstedt v Council* [1968] E.C.R. 409, at 415.

72 Council Regulation (EEC) No 1210/90 of 7 May 1990 on the establishment of the European Environment Agency and the European environment information and observation network

73 The LIFE+ Regulation (EC) No 614/2007

74 Decision 2004/387/EC of the European Parliament and of the Council of 21 April 2004 on interoperable delivery of pan-European eGovernment services to public administrations, businesses and citizens (IDABC), OJ L 181, 18.5.2004, p. 25.

1. carry on as before

2. charge an existing institution

3. develop a new body

4. charge an organisation through a competitive call

7.3.1 Stakeholder Opinion

About 80% of those consulted thought that EMODnet should be built on existing structures with just under 50% strongly supporting such an idea. Although clearly this is a convincing majority, support for this principle was slightly less than for the other guiding principles. Support was stronger from national government bodies than from either the private sector or research communities.

The stakeholders were asked which existing structures might have a role in the new EMODnet. Mostly they named national bodies which could certainly have a role in collecting data on national scale or even processing them on a sea-basin scale. However none of these are obvious contenders for the role of secretariat.

The main transnational bodies identified were the International Council for Exploration of the Sea in Copenhagen and EuroGOOS - four times each. The European Environment Agency was identified twice and JRC once.

7.3.2 Primary impacts

The primary impacts were defined (section 6.1) as reduced operational costs for public and private concerns, increased competition for value-added services, reduced uncertainty in the state of the oceans and increased implementation costs.

These impacts are compared to the "carry on as usual" scenario so, by definition, option 1, "carry on as usual" ,would have zero impact.

Furthermore the three other options could, in theory, be implemented to achieve the same impacts in terms of reducing operational costs, increasing competition and reducing uncertainty. Therefore the economic, social and environmental benefits derived from these primary benefits would also be identical. They would largely depend on the actual content of the new policy – collecting data or assembling and processing them as described in section 7.1. The difference would be in the cost and effort required to implement the new infrastructure.

7.3.3 Implementation Costs

In the short term using an existing body – for instance ICES, EUROGOOS, JRC or EEA - would certainly be easier and cheaper than setting up a new body. The administrative procedures are tried and tested. In the longer-=term a call for temder might be cheapest.

7.3.4 Conclusion

Option 1, carrying on as before, would not resolve the present difficulties with marine data described in section 3.1.

Each of the four existing bodies suggested in option 2 would be capable of doing the job. ICES is not a European body but is an intergovernmental body whose members include States from outside the European Economic Area (Canada and United States) and excludes many Member States (notably those from the Mediterranean and Black Sea).

1. EUROGOOS is primarily concerned with real-time operational monitoring of physical parameters whereas EMODnet aims to cover a much wider scope – sea-beds, biodiversity etc

2. The European Environment Agency has an environmental mission aimed at the needs of public authorities whereas the EMODnet infrastructure should serve the needs of industry and research as well. In any case the Environment Agency would be prime users of EMODnet, drawing on the more basic data to construct the indicators that meet their needs. Indeed the WISE-marine tool that they are constructing, which is part of the Shared Environmental Information System, aims to do just that.

3. The Joint Research Centre has a mission to support EU policy with research. It does not have the mandate for a long-term operational task.

There are no obvious legal impediments to any of these taking on this role. However each would require an extension of their present scope and a specific governance structure independent from that currently applied for their respective work programmes.

The stakeholder survey suggests that none of these organisations has a mission that would automatically qualify it for hosting the secretariat. Stakeholders were specifically asked which existing organisations could contribute. Out of the 300 replies, less than three nominated one of these four. However all would have the administrative experience to do the job. With the possible exception of EUROGOOS[75] they are accustomed to reporting, handling contracts and hosting committees. Hence one can conclude that enlarging the mandate of an existing organisation is an option to consider.

Option 3 would allow a specially constructed consortium to do the work. It would take longer to set up and cost more in the short term. However, creating a body whose mission is solely dedicated to improving Europe's marine data infrastructure would provide focus, continuity and sustainability.

Option 4, choosing the secretariat through a call for tender, might be the cheapest procedure but would require renewal through further calls for tender so potentially

[75] Although it has been suggested that this might be implemented jointly with the European Science Foundation's Marine Board

creating discontinuities and administrative overhead. It should be noted that the existing organisations mentioned under point 2 could apply under the call.

The decision should be taken on the grounds of cost effectiveness. In any case no decision is required at this point.

7.4 Incentives

If it is to be fully successful two types of data should be available through EMODnet

1. Seamless map-layers – for instance of gridded data

2. The raw measurements in standard formats

It is expected that the majority of users will be content with only the derived map layers but a significant number will also need to examine the raw measurements in order to check the quality and applicability of the data. Indeed any checks on data will also benefit thee data provider.

The EU can insist that the derived seamless map layers be made publicly available because they were produced through EU action. The raw measurements, however, remain the intellectual property of the bodies that either produced them or funded their production so disseminating them requires their assent and cooperation. We can distinguish between data collected through publicly and privately funded actions.

7.4.1 Privately-collected data

There is no intention to apply pressure, legal or moral, on private operators to deliver data that they have collected with their own means. However a number may be willing to hand-over their data for safe-keeping. At present there is no mechanism for them to do so but within the preparatory actions, an experimental database is being developed that can store and distribute hydrographical survey data. In this way those bodies that wish to hand over data will be able to do so at little cost to themselves. Other than being seen as responsible operators in the marine environment, they would benefit from easy access to their own data and that of others without having to invest in the information technology themselves.

7.4.2 Publicly Collected data

The discouraging of cost recovery charging is consistent with other EU initiatives in particular the Directive on the Re-use of Public Information (section 4.4).

A survey of the main marine data providers in 2003[76] showed that very little income was generated from the sales of data to private bodies – approximately £70,000 – compared to the total public funding of these bodies – more than £1 billion (Table 8). Sales to public bodies are not included here because their net contribution to the public purse is zero.

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[76] Rayner R., J. Smallman, G. Cameron, C. Wallace, Achieving optimal value from publicly funded marine information resources A report prepared by the UK Marine Information Council Working Group on Data Access

Table 8 UK public sector bodies Revenue from data sales for financial years 1999-2000 and 2000-2001.

Body	Annual Revenue from data sales to private bodies	Total Annual funding
Centre for Environment, Fisheries & Aquaculture (CEFAS)	0	£28,500,000
Department of Agriculture and Rural Development Northern Ireland (DARDNI)	0	£5,000,000
Environment Agency (EA)	0	£649,500,000
FisheriesResearch Service (FRS)	£3,000	£2,000,000
UK Meteorological Office (UKMO)	£18,000	£15,000,000
Natural Environment Research Council (NERC)	£28,000	£243,000,000
Scottish Environmental Protection Agency (SEPA)	0	£33,500,000
UK Hydrographic Office (UKHO)	£20,000	£47,000,000
total	**£69,000**	**£1,023,500,00**

This confirms that the loss of revenue from commercial sales of marine data would not in itself hurt these organisations. Any loss of sales to public bodies could be compensated by a realignment of the public funding from the data user to the data provider.

Although greater competition resulting from a freer availability of data may hurt some public bodies who no longer have a monopoly on the production and dissemination of added-value products, there will be some compensation. Firstly these bodies will benefit from freer data policies from other operators producing marine data and secondly it is expected that the overall market for value-added products will increase.

8 MONITORING AND EVALUATION

8.1 Indicators

Based on the principles that the indicators should be quantitative and not impose a heavy burden for collection of data, the following indicators are proposed.

Resource indicators — The resources used to run the Network broken down into:

1. cost of Commission staff to set-up and monitor Network
2. cost of secretariat
3. resources provided to assemble and process data

Output indicators

1. number of parameters where complete picture of European observation effort is available
2. number of parameters made available for downloading over complete sea-basins

Impact indicators

1. to measure improvement in operational efficiency
    a. (for industry) number of private companies downloading data through EMODnet
    b. (for public administration) number of public administrations downloading data from EMODnet
    c. (for science) number of papers on marine science published in "Nature" and "Science" led by European authors
2. (to measure increased competition) average number of bidders for Commission service contracts requiring marine data
3. (to measure reduction in uncertainty) range of values for sea-level rise in 50 years time used in assessment of UK and Netherlands sea-defence strategies.

8.2 Monitoring and Evaluation

Some of these indicators are indirect. The best way to measure operational efficiency or the number of start-up companies based on marine data would be to conduct surveys of companies. However this would be expensive to do thoroughly. Data downloads are a good proxy. Presumably private companies would not download data unless it were useful to their business.

The Marine Observation and Data Expert Group will continue to advise the Commission on the effectiveness of EMODnet and highlight any shortcomings that need to be addressed.

ANNEX 1 GLOSSARY

COMP	European Commission Directorate General for Competition
ECHAM	a Global Climate Model developed by the Max Planck Institute for Meteorology
EEA	European Environment Agency
EIONET	a partnership network of the European Environment Agency (EEA) and its member and cooperating countries supporting the collection and organisation of data and the development and dissemination of information concerning Europe's environment
EMODnet	European Marine Observation and Data Network
ENV	European Commission Directorate General for the Environment
ERFF	UK Environment Research Funders Forum
ERIC	European Research Infrastructure Consortium (Community legal framework for)
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures:
EUMETSAT	The European Organisation for the Exploitation of Meteorological Satellites
EUROGOOS	an Association of Agencies, founded in 1994, to further the development of Operational Oceanography in the European Sea areas and adjacent oceans
GDP	Gross domestic product, a basic measure of a country's economic performance,
GEOSEAS	Seventh Framework Programme Infrastructures project to improve overview and access to marine geological and geophysical data and data-products from ational geological surveys and research institutes in Europe by upgrading and interconnecting their present infrastructures.
GEOSS	Global Earth Observation System of Systems to be delivered by a voluntary partnership of governments and international organizations
GMES	Global Monitoring for Environment and Security
ICES	International Council for Exploration of the Sea
INFSO	European Commission Directorate General for Information Society and Media

INSPIRE	Infrastructure for Spatial Information in the European Community
JRC	European Commission Joint Research Centre
LIFE	The EU's financial instrument supporting environmental and nature conservation projects throughout the EU
MARE	Directive General for Maritime Affairs and Fisheries DG
MODEG	European Marine Observation and Data Expert Group
MyOCEAN	Seventh Framework Programme project forerunner of the GMES Marine Core Service, aiming at deploying the first concerted and integrated pan-European capacity for Ocean Monitoring and Forecasting
NOAA	United States National Oceanic and Atmospheric Administration (NOAA)
RTD.	European Commission Directorate General for Research
SEADATANET	Sixth Framework Programme project aimed at developing a Pan-European infrastructure for managing, indexing and providing access to ocean and marine data sets and data products
SEIS	Shared Environmental Information System - a collaborative initiative of the European Commission and the European Environment Agency (EEA)
SME	Small and Medium Enterprise[77]
SST	Seas surface temperature
Ur-EMODnet	A prototype EMODnet
WISE-Marine	WISE-Marine is the marine environmental component of the Shared Environmental Information System

[77] See http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/sme_user_guide.pdf for a complete definition

ANNEX 2 STAKEHOLDER CONSULTATION

Procedure and outcome

The ambition to set up a Marine Observation and Data Network was first aired in public through the Green Paper on maritime policy[78]. 487 stakeholders replied including the national administrations of all EU coastal states and more than 100 local authorities. Although there were various suggestions as to how such a network should be constructed, opinion was overwhelming that such an initiative was needed. The Commission therefore included a proposal to take further steps in its Blue Book on maritime policy in October 2007.

Following further consultation with the Marine Observation and Data Expert Group and after gathering feedback from presentations at a number of gatherings of marine specialists, a roadmap was produced in April 2009 setting out broad principles and a timetable for moving ahead.

Simultaneously a new public consultation was launched. 300 stakeholders replied in two months - 42% on behalf of their organisations, 46% from a personal viewpoint but based on their working experience and 12% from a general concern about the sea (12%).

Based on their own self-classification, these stakeholders were divided onto four groups – private companies, public authorities, the research community and "others". These four groups were sufficiently large to provide statistical confidence in the results. The research community was the largest group. It included public and private research organisations as well as universities. 60 of the public authorities were at a national level; 15 were at a regional or local level.

Table 9 indicates the end-use of the data. 60% of researchers saw understanding the planet's behaviour and applying this knowledge for marine management as primary applications for data. The authorities and private sector were more varied in their use. 40% of the private sector used data to help them exploit resources, develop new infrastructure or protect coastlines. Of the authorities, 40% saw informing the public and managing marine resources as primary objectives. Nearly 30% of both private bodies and public authorities were involved in ensuring safe navigation.

[78] COM(2006) 275 final

Table 9 Why do the stakeholders require marine data? They were allowed to choose up to three. The numbers indicate the percentage of the stakeholder group who chose a particular purpose

reason	private	authority	research	other
behaviour of the planet	8	18	62	35
coastal protection	39	36	23	20
exploit resources	42	15	17	15
inform the public	8	40	29	45
marine management	26	46	62	65
national defence	0	10	1	0
new developments	47	33	22	18
promote or support tourism	0	3	1	5
regulatory requirement	18	26	13	28
safe navigation	32	31	4	10
teaching students	8	4	23	8

Those stakeholders who used marine data in the course of their daily work were asked which type of data they required. The data were classified according to the types defined in the Roadmap.

Figure 3 confirms that nearly all stakeholders need more than one class of data. Each class of data was useful to at least 60% of stakeholders. 90% of stakeholders required physical and bathymetric data with more than 60% expressing strong needs. These results are consistent with a 1999 analysis by EuroGOOS[79] which provided a more detailed breakdown on the type of data required. For instance physics is broken down into current direction, current velocity, sea surface temperature, wave direction spectrum etc.

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Figure 3 Usefulness of data (expressed as percentages of number replying to question). The numbers on the right are the total number replying to this question

The roadmap identified 8 principles for a sustainable marine data infrastructure. Stakeholders were asked their opinion on these principles. 70% strongly agreed and 90% in total agreed with the first five principles:

1. provide sustainable financing at an EU level

2. interoperability - develop standards across disciplines as well as within them

3. multi-use collect data once and use it many times

4. provide free- data - discourage cost-recovery pricing from public bodies.

5. accompany data with statements on ownership, accuracy and precision

Agreement on the other three was also strong but somewhat lower. Approximately 40% strongly agreed and 80% in total agreed with the following principles.

6. process data at sea-basin level

[79] Operational Oceanography Data Requirements Survey EuroGOOS Publication No. 12 February 1999, EG99.04

7. build on existing efforts

8. develop a decision-making process for priorities that is user-driven

The complete outcome of this stakeholder consultation is reported in a separate document[80]. Relevant elements are inserted whenever appropriate throughout this report.

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Figure 4 opinion of those consulted on 8 principles for a better marine data infrastructure as identified in Roadmap

Commission Minimum Standards

Commission standards have been applied.

1. Extensive brainstorming took place before the consultation – not only with the Expert Group but also at numerous conferences where marine issues were discussed.

2. A document (the roadmap[4]) was provided outlining the issues. Approximately half those consulted had read the document. Half of these had read the full 60-page document. The rest had read the 5-page executive summary only.

3. The maritime policy web-site drew attention to the consultation. Mailing lists of stakeholders were informed. A number of interest groups published the information on their own newsletters. The number of replies from each coastal Member State is broadly in line with their population.

4. The questionnaire was clear. Stakeholders were invited to reply "do not understand the question". On no question did more than 3% of those surveyed declare that this was the case.

5. The minimum time of eight weeks for the consultation was respected.

6. A statistical analysis of the consultation was posted on the Europa web-site the day after the consultation closed and all contributors were informed by e-mail.

[80] Marine data infrastructure

ANNEX 3 CURRENT SPENDING

Space

Table 10 Spending on space measurements of seas and oceans. These figures include development, launch and operation of satellites by the European Space Agency (ESA), European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and national bodies. Each sensor can monitor both land and ocean. The costs were attributed to marine use depending on the use to which the data were put and only the marine component is included in this table. This attribution introduces an error margin of ±25%. Source European Space Agency. Private Communication

Organisation	measurements provided	2007	2008	2009	2010	2011	2012	2013
ESA	SST, sea level, ocean colour, ocean currents, sea surface salinity, surface waves, oil pollution, sea ice, icebergs, coastal change, ocean surface winds	200	200	350	350	350	450	350
Eumetsat	SST, sea ice concentration, ocean surface winds	36	30	30	30	30	30	
national	sea level	35	35	35	35	35		
	TOTAL	271	265	415	415	415	480	350

In 2009 approximately €415 million was spent on monitoring seas and oceans from space .

Costs of individual organisations

The study performed specifically for this assessment found that in nearly all institutions, data handling is a horizontal activity over all marine activities and it is therefore hard to ascertain how much they are spending. Table 10 shows spending by organisations in Spain, France, Netherlands, Sweden and UK.

Table 11Results of survey of major data-holders in selected Member States. They were asked to assess what they spent on collecting, archiving and distributing data

MS	Institution	Total Turnover (€)	Total Expenditure (€)	Average Expenditure (€)	% Expenditure to Turnover
Spain	CEDEX	55.7	2.78	-	5
Spain	CSIC UTM	n/a	n/a	-	n/a
Spain	IRTA	8.1	n/a	-	n/a
Spain	Puertos de Estado	n/a	n/a	-	n/a
Spain	CEMMA	0.2	0.02	-	10
Spain	Instituto de Ecología Litoral	0.6	0.4	-	67.7
Spain	IEO	68	21	-	30.9
Spain	**Total**	**76.9**	**24.2**	**7.14**	**28%**
France	SHOM	75 mil[81]	24.8 mil[82]	-	33.1
France	INSU CNRS	n/a	n/a	-	n/a
France	IRD	219 mil	6mil[83]	-	2.7

[81] SHOM turnover + costs related to the use of the vessels

[82] fleet costs (€20 mil), satellite data spends (80,000) and cost of database base project (€4.2 mil)

France	IPEV	23 mil	20.7 mil	-	90
France	CNES	1423 mil	15 mil	-	1.1
France	CLS	24.54 mil	n/a	-	n/a
France	IFREMER	230 mil	70 mil	-	30.4
France	E-SURFMAR	0.82mil	0.13 mil	-	15.9
France	CETMEF	0.335 mil	0.134 mil[84]	-	40
France	Institut de Physique du Globe de Paris	34 mil	7.69 mil	-	22.6
France	SOMLIT	n/a	1.3 mil	-	n/a
France	CNRS University de Perpignan	0.3mil	n/a	-	n/a
France	Université de la Rochelle, CRMM	n/a	n/a	-	n/a
France	Bureau Gravimetrique Int'l	0.15 mil	0.1125 mil[85]	-	75
France	**Total**	**2030.1**	**145.9**	**14.6**	**7.2%**
Netherlands	Hydrographic Services, Royal Navy	5.3 mil	5.3 mil	-	100
Netherlands	NIOZ	20 mil	0.25mil	-	1.25
Netherlands	Rijkswaterstaat	3500 mil[86]	26mil	-	0.75
Netherlands	Port of Rotterdam	450 mil	n/a	-	n/a
Netherlands	Total	3975 mil	31.6 mil*	€10.5 mil*	0.8%
Sweden	Swedish Environment Protection Agency	330.5 mil	4 mil	-	1.2
Sweden	SMHI	53.5 mil	2.4 mil	-	4.5
Sweden	Swedish Maritime Administration, Hydrographic Office	192.6 mil	13.5 mil	-	7
Sweden	Swedish Board of Fisheries	27.9 mil	3.63 mil	-	13
Sweden	Geological Survey, Sweden	22.8 mil	2.16 mil	-	9.5
Sweden	Sven Loven Centre for Marine Sciences	5.15 mil	0.15 mil	-	2.8
Sweden	Umea Marine Sciences	2.5 mil	1 mil	-	50
Sweden	**Total**	**635 mil**	**26.8 mil**	**3.8 mil**	**4.2%**
UK	Marine Scotland	29.4 mil	10.9 mil	-	37
UK	UKHO	109 mil	5.45 mil	-	5
UK	CEFAS	62.74 mil[87]	35.12 mil	-	56
UK	Maritime & Coastguard Agency	130 mil[88]	6 mil	-	4.6
UK	British Oceanography Data Centre	1.5 mil	1.5 mil	-	100
UK	British Atmospheric Data Centre	2.2 mil[89]	1.5 mil[90]	-	68
UK	Seafish	8.8 mil	3.3 mil	-	38
UK	**Total**	**343.6 mil**	**63.7 mil**	**9.1 mil**	**18.5%**
	TOTAL	**3480.6mil**	**289.4mil**	**57.9mil**	**8.3%**

These figures include some of the larger European institutions but even in those Member States covered by the study, there are serious gaps. The UK's Environment Research Funders Forum (ERFF) estimates that the UK provides £36 million[91] per year for marine monitoring[92]; about 7% of what is spent for terrestrial monitoring.

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83 €4.5 million spent on fleet

84 Excluding salaries which are provided by participating public institutes

85 Excluding salaries which are provided by participating public institutes

86 http://www.rijkswaterstaat.nl/images/Annual%20report%20Rijkswaterstaat%202006_tcm174-134643.pdf

87 http://www.cefas.co.uk/media/133189/cefas_ara_2008-9.pdf

88 http://www.mcga.gov.uk/c4mca/197-336_mca_ar_loresnav.pdf

89 Turnover of organisation that hosts BADC

90 This is all data, most of it is not marine data

91 €42 million now, about €50 million then

92 House of Commons Science and Technology Committee "Investigating the Oceans" Tenth Report of Session 2006–07, Volume I

However it is not clear, even in the report where this number is introduced[93] what is included within "monitoring". – defence expenditure, work back at the lab, DNA of marine species, commercial data gathering, shared overheads, concealed capital costs or sunk investments.

Another way of estimating the effort spent on monitoring is to look at the cost of research and survey fleets (Table 12 and Table 13).

Table 12 Fleet expenditure by public bodies

MS	Organisation	Total no. vessels	No. major vessels	No. days at sea	No. minor vessels	No. sea days	Ave. cost per day	Annual spend
	IHM/Armada	4	4	1,320	0	0	19,333	25,520,000
	CEMMA	1	1	30	0	0	1,666	50,000
	Universidad de Oviedo	1	1	24	0	0	0	0
	IRTA	1	1	150	0		1,233	185,000
	IEO	7	7	1,540	0	0	4,440	5,860,360
	Other vessels	3	3	267	0	0	9,300	1,810,000
	CSIC	2	2	440	0	0	7,500	3,300,000
ES		**19**	**19**	**3,771**	**0**	**0**	**9,739**	**36,725,360**
	SHOM	12	5	900	7	1,540	29,000	26,250,000
	IRD	2	2	504	0	0	8,762	4,415,796
	IPEV	3	3	n/a	0	0	18,500	8,640,000
	INSU CNRS	12	4	1,227	8	1,695	1,102	3,890,665
	average others	2	2	310	0	0	_	990,000
	IFREMER	7	7	1,477	0	0	15,333	18,665,000
FR		**38**	**23**	**4,418**	**15**	**3,235**	**8,212**	**62,851,461**
	Rijkswaterstaat	25	10	2,220	15	3,300	12,380	68,090,000
	Hydrographic Services of the RN	3	3	765	0	0	14,705	11,250,000
	NIOZ	2	2	440	0	0	6,818	3,000,000
NL		**28**	**13**	**3,425**	**15**	**3,300**	**12,623**	**82,340,000**
	Sven Loven Centre for Marine Science	3	3	175	3	n/a	4,937	863,975
	Geological Society Sweden	1	1	100	0	0	8,000	800,000
	Swedish Coast Guard	1	1	220	0	0	15,000	3,300,000
	Maritime Authority, Hydrographic Office	2	2	290	2	n/a	14,724	4,269,960
	SMHI	2	2	78	1	n/a	14,916	1,163,448
	Swedish Fisheries Board	1	1	200	1	n/a	7,458	1,491,600
SE		**10**	**10**	**1,063**	**0**	**0**	**11,1843**	**11,888,983**
	Marine Scotland	2	2	600	0	0	23,529	6,000,000
	CEFAS	1	1	250	0	0	10,000	4,500,000
	Maritime & Coastguard Agency	3	3	570	0	0	10,000	6,000,000
	UKHO/Royal Navy	2	2	250	0	0	20,000	5,000,000
UK		**6**	**6**	**1,670**	**0**	**0**	**9281**	**15,500,000**

93 J A Slater , A C Mole & R Waring Strategic Analysis of UK Environmental Monitoring, Activity for ERFF, Final Report, October 2006,

Table 13 Fleet costs for private bodies

MS	Institution name	Number of major vessels	Number of minor vessels	Ave. cost Per Day (Euro)
	Fugro	65[94]	0	25,000[95]
	BMAPA	0	0	13,700
	Associated British Ports	8	0	9,000[96]
	London Gateway (DP World)	0	0	21,800
	REPSOL	0	0	45,000[97]
	AZTI	several	several	4,500[98]
	Shell	0	0	-
	BP	0	0	-
	TOTAL	0	0	75,000 [99]
			AVERAGE per day: 27,714	

The average rental cost per day varies greatly. It clearly depends on the size and nature of the vessel although the costs declared by private companies are, on the whole, higher – possibly because users in the public sector do not always pay the full costs.

A study by the Marine Board estimated that EU researchers spent 8 713 total research fleet days per year[100]. At an average cost of €20 000 per day this works out at a cost of €160 million per year for their institutions. However this probably does not represent the full cost of these vessels. Nor does it include hydrographic surveys which are normally paid from the defence budget rather than the research budget.

A paper[101] from the European Strategy Forum for Research Infrastructures (ESFRI) suggests that that 50% of the marine science budget is spent on operating and replacing marine infrastructure including research vessels and associated marine equipment. They found it very difficult to obtain an overview of spending but concluded that in the period 2003-2013, 15 new large vessels will be added at a cost of €125 million per year. This does not include the smaller vessels.

Scaling up

Sweden and Netherlands appear to be spending far more of their national income, as a proportion of GDP, than France and UK. This is no doubt partly due to under-estimates for spending in France and UK. For instance the UK figure does not

94 55 vessels of their own plus charter time on 10 vessels, more or less

95 25,000 is for standard multi-beam survey, does not include use of AUVs or ROVs

96 Based on under 10m vessels < €5000 per day and ocean-going vessels approx. €25,000 per day

97 Costs vary between 20,000-70,000 euros. Mostly Mediterranean region.

98 Costs vary between €3000-6000.

99 Costs vary between €50,000– 100,000. Many surveys carried out off shore mainland Africa.

100 Data source: European Ocean Research Fleets, Position Paper 10, Marine Board - ESF, March 2007, Table 2 and Appendix 1",

101 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

include spending by the National Environmental Research Council which operates four large ships. There is not enough data on Spain to draw any conclusions.

If we calculate the average spending per GDP for these four countries and scale up by the GDP of coastal EU states we arrive at a lower limit for EU spending of €815 million. If space is included, then allowing for currency fluctuations and uncertainties, this is about the same level as the $1 billion[102] that the United States was spending annually on its ocean observing in 2002. A safe estimate for a minimum value for Europe's current public spending on sea and ocean monitoring would be €1 billion.

[102] Building consensus: toward an integrated and sustained ocean observing system Ocean.US Workshop Proceedings Airlie House, Warrenton, Virginia March 10-15, 2002

This is not the first time that such deficiencies have been identified. The European marine data infrastructure issue is part of a wider debate on the potential gains of wider access to public information, of better sharing of scientific data and of more coordinated monitoring of the planet. And the EU has already begun a number of initiatives aiming to alleviate barriers that prevent progress on these issues. These have already been described in the EMODnet roadmap[4]. In this section we summarise the findings and explain how EMODnet fits in with these other actions.

Obligations

The EU's primary tools for promoting better discovery of data, freer access to data and fewer restrictions on use of data-use conditions are

1. the INSPIRE Directive[103] which obliges Member States to adopt measures for the sharing of data sets and services between its public authorities,

2. the Environmental Information Directive[104] which requires them to release the data when asked and

3. the Public Sector Information Directive[105] which facilitates the re-use of public data buy by insisting that it is provided to all third parties under the same conditions.

These oblige Member States to adopt appropriate measures in order to achieve the desired objectives. A study[106] clarified why these measures were not sufficient to remove the barriers to the use of marine data described in section 2.2.2. Broadly speaking the study concluded that Member States have correctly implemented the legislation at national level. However the rules for INSPIRE and the Environmental Information Directive only apply only to bodies that exert public authority which excludes research centres and some other bodies unless they are handling data on behalf of a public authority.

Even for public authorities, access and re-use of data is largely governed by intellectual property rights. Data held by public authorities have largely been obtained with intellectual rights attached and neither the INSPIRE Directive nor the Environmental Information Directive override these restrictions. None of these Directives forbid charging on a cost-recovery basis.

In other words there is not a problem of non-implementation of existing international and European rules in terms of access to and the use/re-use of marine environmental data, rather that those rules have a limited impact on intellectual property rights and thus in their ability to facilitate data flows.

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103 Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community.

104 2003/4/EC

105 2003/98/EC

106 Legal aspects of marine environmental data Framework Service Contract, No. FISH/2006/09 – LOT2, Final Report – October 2008

However whilst these Directives are not sufficient to facilitate access, they are necessary. For instance INSPIRE sets a basic framework for spatial data standards that will be completely adopted by ur-EMODnet and EMODnet. In return EMODnet will feed back proposals for INSPIRE standards that are specific to the marine world. This will help ensure that marine data is compatible with terrestrial data.

Enabling Actions

As well as the actions obliging Member States to release data, a number of actions have taken place to facilitate the setting up of a marine data infrastructure. These include the Data Collection Regulation for fisheries[107], projects conducted under the EU's Framework Programmes for research, GMES, SEIS and WISE-marine.

Data Collection Regulation

The Community provides €44 million annually for the collection of fisheries data through the Data Collection Regulation. Its latest revision[31] has reduced the restrictions on access and use of data. It now obliges national authorities holding fisheries data to allow access for scientific advice, research and public debate and to grant the Commission access to national computerised databases through bilateral agreements.

The Commission's Joint Research Centre (JRC) has been responsible for collecting data from different Member States in order to support assessments of particular stocks or particular areas. The International Council for Exploration of the Sea (ICES) uses some of these data in assessing stocks or providing management advice.

Although the Regulation is focused on fisheries it now includes a limited number of parameters – by-catch etc – that enable an estimation of fishing pressure on the ecosystem. However a full estimate of the state of the ecosystem requires more data on habitats and on the distribution and abundance of species that are not commercially fished. Spawning and recruitmengt depend on photosynthesis, light energy, photosynthetically available radiation (PAR), and phytoplankton productivity. These in turn are related to the water temperature, clarity, suspended sediments, and nutrients. The scope of this Regulation is limited by its legal basis in article 37 of the Treaty of the European Communities to fisheries so it cannot be extended to cover these issues.

It is planned that EMODnet will complement the Regulation so that users will be able to integrate fisheries data with other data in a seamless way. This will be achieved through common standards and quality control.

Framework Programme Projects

A number of projects partly financed by the EU's Framework Programme for research such as SEADATANET and GEOSEAS have gone some way towards meeting the objectives of EMODnet. Each of them aims to provide better access to particular types of marine data held by Member States by setting up catalogues, defining standards and developing the algorithms and software necessary to assemble

[107] Council regulation N° 199/2008/EC

data. The partnerships developed within these projects have led to a greater awareness of what is being done in other Member States. However:

the research funding mechanism is really designed to support innovation whereas what is needed is largely a routine cataloguing and data management. The work programmes of such projects are often a compromise between the universally acknowledged need to improve access to data and the legal requirement to comply with the general rules for EU research projects.

1. such projects are of finite duration. Continuations are not automatic and depend on the overall priorities of the Community's research programme. Once the project stops, partnerships dissolve and structures are no longer maintained. While preparatory phase projects for new research infrastructures should lead to long-term sustainability, there is no explicit or implicit intention for continued EU support.

2. it can be difficult to steer research projects towards pre-defined deliverables. Consortia are invited to submit proposals that meet broad objectives.

Although these projects contribute substantially to the knowledge base of the EU, they are too patchy and too limited in time to constitute a network.

Global Monitoring for Environment and Security

The Global Monitoring for Environment and Security (GMES) programme provides support to marine data infrastructure in two ways – first it contributes towards the funding of satellites to monitor the marine environment and secondly it supports a "marine core service" which can be considered as the forerunner to an ocean forecasting system. This system will deliver both data on the ocean surface from satellites and forecasts on a coarse scale for the global ocean and on a finer scale for the Arctic Ocean, Atlantic (North West Shelf and Iberian coast), Baltic, Black Sea and Mediterranean. Obviously data in such projects are transmitted and managed in real-time. In parallel with rapid real-time use, the same data are streamed towards an archive where they are cleaned up, polished, re-calibrated, and archived for future reference, climatology, etc. For obvious reasons, delayed mode data are more accurate than real-time data. You have to trade off speed for accuracy.

This will be done on a prototype basis through the MyOcean[108] project which started in 2009 and is funded to the tune of €33 million through the Framework Programme (and hence suffers from the difficulties outlined in section 2). However from 2014 onwards it is possible that some provision will be made in the EU budget for an operational service.

The marine core service is primarily concerned with physical data – temperature, salinity, current etc - so at the outset, in order to avoid overlaps, ur-EMODnet focuses on other parameters – bathymetry, geology, chemistry and biology. But there are connections. Better bathymetry data from EMODnet will help physical monitoring in MyOcean. And, as the MyOcean project progresses, other gaps will be identified. Non-space-derived measurements are needed to drive the circulation

[108] http://myocean.oceanobs.com/

models of MyOcean - especially the Argo floats[109]. EMODnet might contribute to the observation system (see 6.1.4.2). The near-coastal tidal regions are not covered by the marine core service so the collection or assembly of physical measurements of these areas might come within the scope of EMODnet.

Further opportunities for identifying synergies between the two initiatives will be sought as the current projects mature.

SEIS and WISE-marine

The Shared Environmental Information System SEIS[110], a collaborative initiative of the European Commission and the European Environment Agency (EEA), is an approach aiming to modernise and simplify the collection, exchange and use of the data and information required for the design and implementation of environmental policy, according to which the current, mostly centralised systems for reporting are progressively replaced by systems based on access, sharing and interoperability.

WISE-marine is the marine environmental component of SEIS intended to fulfil the requirements of implementation of the reporting obligations of the Marine Strategy Framework Directive 2008/56/EC. It will be an extension of the current Water Information System for Europe (WISE) system which covers near coastal waters towards the marine environment.

The EMODnet processing chains stops at the assembly of data. WISE-marine processes these data to calculate indicators. The ur-EMODnet biological and chemical components being constructed under preparatory actions have been chosen specifically to facilitate the construction of environmental indicators for WISE-marine.

European Agencies

The mandates of the European Maritime Safety Agency and the Community Fisheries Control Agency are more about the enforcement of maritime or fisheries rules than the provision of data for setting up these rules. However the European Maritime Safety Agency does act as a hub for distribution of vessel traffic information which, provided that suitable safeguards regarding commercial confidentiality were observed, might, in an appropriate aggregated form, be disseminated more widely.

Ur-EMODnet

Ur-EMODnet is a prototype EMODnet being constructed under preparatory action funding. According to the Financial Regulation:

> *The preparatory actions are to follow a coherent approach and may take various forms. The relevant commitment appropriations may be entered in the budget for not more than three successive financial years.*

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109 small, drifting oceanic robotic probes deployed worldwide

110 Towards a Shared Environmental Information System (SEIS) COM(2008) 46 final Brussels, 1 February 2008

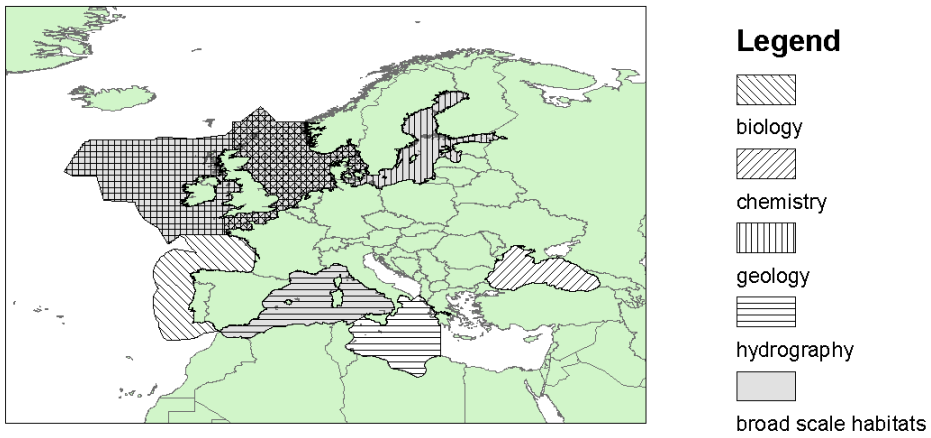

Figure 5 layers being developed for ur-EMODnet under the first year's preparatory actions. All data layers are covered in th North sea. The habitat map players are constructed from the other data layers and will indicate how easy it is to use the data coming from ur-EMODnet

The preparatory actions from budgetary year 2008 are being implemented by five consortia. Each consortium is responsible for one data theme. Each one is aiming to develop map layers of two basic types:

1. showing who is collecting data and where it is being collected For instance for bathymetry the map layer will show the position and characteristics of surveys which generally follow the track of a ship.

2. assembling these data into seamless map-layers with public access. For bathymetry the map layers will show a regular grid indicating a water depth at each point of the grid together with an estimate of precision.

In order to avoid making wrong choices and in order to fit within the budget allocation for the preparatory actions, ur-EMODnet is being constructed with more modest ambitions than a full EMODnet:

1. Geographical scope. Each category of data is only being assembled over a limited number of sea-basins. All are being assembled in the North Sea which is being taken as a reference and each category of data is also collected over one or more other basins. Figure 5 shows the geographical distribution of each parameter

2. Range of parameters collected within each theme. The aim has been to assemble representative parameters rather than the complete set - examples of synthetic compounds, heavy metals, radionuclides, fertilisers, organic material and hydrocarbons for the chemical lot and examples of phytoplankton, zooplankton, angiosperms , macro-algae, invertebrate bottom fauna, bird communities, sea mammals., reptiles for the biological layers.

3. Resolution. High resolution data is best, since it records the maximum possible number of measured points per unit area or per unit of time. It is possible to process high resolution data into lower resolution data by smoothing or averaging, but not the other way round.". It is possible to process high resolution data into lower resolution data but not the other way round. However producing seamless high resolution map layers over a whole sea basin is difficult because:

a. processing the data from the raw data is much more time-consuming.

b. data owners are more reluctant to allow public access to high resolution data than for lower resolution data

c. in some parts of the sea-basin, the raw data needed to produce the seamless map may be at too low a resolution

For this reasons some of the ur-EMODnet seamless layers are being produced at a relatively low resolution. The bathymetry map layer will be delivered on a grid one quarter of a minute of longitude and latitude and the geological map at a one to one million scale. These are still at a higher resolution than anything that has been available on a sea-basin scale up to now but for many applications, higher resolution data will be required.

4. Certain data themes are not considered; in particular physical data, fisheries data and human activity data.

a. fisheries data is dealt with under the Data Collection Regulation for fisheries. It is intended that ur-EMODnet and the Data Collection Regulation become progressively aligned.

b. Physical data - currents, tides, waves, temperature ,density etc - is dealt with by the GMES initiative. There are gaps as indicated in section 3 but it was judged appropriate to wait till these gaps became clearer before embarking on an action to deliver physical data.

c. Human activity data (other than fisheries) includes parameters such as gravel extraction activity, shipping lanes and aquaculture characteristics. These data are essential for spatial planning or estimating environmental pressure for the Marine Strategy Framework Directive. However the preparatory action budget could not stretch to assembling these data.

d. Socio-economic data on coastal communities and the maritime economy – employment, profits, age-structure etc. Eurostat are working on improving the quality and comparability of those available at a European level.

Despite these limitations, it is expected that the ur-EMODnet being constructed will not only provide indications of how a future EMODnet will operate but will also provide data that are in themselves useful. The results can then either feed into existing structures or allow for the development of a separate structure.

European Atlas of the Seas

Whilst EMODnet is aimed at providing the material for scientists, public authorities and private bodies with the data they need to provide value added products and services, the European Atlas of the Seas has a wider set of target users. It aims to increase public awareness of the sea, clarify the spatial dimension of EU policies with an impact on the sea and develop the identities of individual sea-basins. Some of the data will be provided by ur-EMODnet. A first version will be published in January 2010 and subsequently refined. The nature of the Atlas, and its inherent

limitations, can never provide the level of detail required for the purposes of EMODnet.

National Programmes

Member States have also been active. Driven by obligations from the Marine Framework Strategy Directive, marine spatial planning and marine protected areas, the UK are beginning to put their marine data in order through the Marine Environmental Data and Information Network (MEDIN) which involves about 30 partners and is costing the agencies responsible for data distribution about €1 million per year. Ifremer, on behalf of the French oceanographic community, are delivering unified access to distributed data through initiatives such as Coriolis (for physical data), Quadrige (for coastal environmental biological and chemical monitoring) and Biocean (for deep ocean biology). There are other initiatives in other Member States

However Member States' actions in isolation are not enough. Each country's territorial or jurisdictional waters are part of a dynamic global system connected by shifting winds, seasonal currents and migrating species. The intergovernmental structures lack the incentives for Member States to establish a European wide EMODnet.

Summary

Table 14 How EU initiatives contribute to marine data infrastructure Research projects and national initiatives are not included. Neither are "obligations' such as INSPIRE. The table only covers "enabling measure" financed in part by the EU budget.

Parameter	**collection**	**assembling**	**Application**
bathymetry		ur-EMODnet	WISE marine
geology		ur-EMODnet	
physics	GMES (space)	GMES (except near coast)	GMES
fisheries (including fisheries economy)	Data Collection Regulation	JRC	ICES
Chemistry		ur-EMODnet	WISE-Marine
biology		ur-EMODnet	WISE Marine
human activity (other than fisheries)			WISE Marine
coastal and maritime economy (except fisheries)		Eurostat	

Classifying in a simple manner the knowledge needed to understand the complex marine world and listing the ongoing EU actions aimed at improving that knowledge inevitably leads to approximations and half-truths. Nevertheless a first-order overview of how the ongoing actions fit together and where the gaps are is useful for providing an overview as a departure point for further discussion. Table 14 shows

how EU initiatives target the different phases of data processing for each of the main types of data defined in the EMODnet roadmap.

EU research projects cover a number of these topics but are not included here because they are not supposed to be permanent structures but rather should develop expertise and provide tools.

GMES is an exception. The GMES umbrella covers the EU contribution to the satellite operation as well as the MyOcean project Although both of these are funded from the research budget, there is an intention that they should be continued as an operational service. For this reason they are included