ANNEX

BACKGROUND PAPER No. 4a

on

THE EUROPEAN MARINE OBSERVATION AND DATA NETWORK

Disclaimer:

The present document has been elaborated by European Commission services for the purpose of providing background material and information to supplement the Green Paper on Maritime Policy (COM … 2006).

This background document is therefore purely illustrative and is not intended to represent the political views, nor to indicate or announce possible future initiatives of the European Commission.

The European Marine Observation and Data Network

ABSTRACT

The EU needs to monitor the state of the planet's seas and oceans because it is committed to their sustainable exploitation and because a better knowledge of their functioning is needed if we are to understand and predict the future environmental conditions of the planet, including its terrestrial component. A number of initiatives are already underway to improve the EU's capabilities in this field, but moving from the current patchwork of activities with scattered data collections, heterogeneous formats, uncertain access to information and sporadic monitoring will require extra efforts over and above those that are already planned.

There is an almost universal consensus that this is an area where action at the EU level provides added value. The physical, chemical and biological connections between national waters must be mirrored in monitoring systems that combine the efforts of single nations into a wider endeavour that allows a complete picture of processes, changes and threats to be built up from a national to a regional and, ultimately, global scale. Building this picture requires the construction of indicators that allow Europeans to monitor trends in the pressure on ecosystems and to assess their health. It requires maps to delineate seabed habitats and zones for human activities. It requires the application of mathematical models for simulating natural processes and human activities. It requires effective communications to integrate the separate components. All of these require guaranteed access to data.

The EU should therefore consider setting up a European Marine Observation and Data Network which will provide a sustainable focus for improving interoperability and increasing access to data. It should not aim to provide services to end-users but rather be a source of primary and-processed data that can serve both public institutions, including their researchers, and commercial providers. These will then be able to answer specific questions and provide services in sectors such as shipping, fisheries, oil exploration, offshore construction, aquaculture, tourism development, coastal protection and defence and so on.

Creating the Network would require the EU to take legislatory, institutional and financial steps. Legislation is needed to facilitate a better access to data generated within the Common Fisheries Policy and the Research Framework Programmes. Institutional changes would include the strengthening of existing bodies at national, regional and European level, the identification of national focal points and the creation of a new secretariat with scientific and information technology expertise. Financial support should aim to be sustainable and long-term. Representatives of those who need the data – including, amongst others, commercial operators, the European Commission, the European Environment Agency and the climate change research community - should continually review priorities and set objectives for this new Network.

There are strong economic arguments for setting up the Network. Data is a public good. Experience from other sectors strongly indicates that improved access to more data allows market forces to generate a wider range of responses and applications than might have been imagined beforehand. Greater availability of marine data should open up new opportunities for high-technology commercial companies in the maritime sector, improve the efficiency of marine operations and research in European institutions and laboratories, contribute significantly towards reducing the current uncertainty about global environmental change and bring seasonal weather forecasting a step closer.

The Network would further support the aims of the Global Monitoring for Environment and Security initiative. Both the proposed marine core service for ocean forecasting and the more specialised services such as ice-monitoring would benefit from easier access to historic time-series and real-time data. It would facilitate the ecosystem approach to fisheries and other marine use. Finally the new Network would properly integrate a number of existing fragmented initiatives and guarantee that the results of this work would not be lost.

CONTENTS

1. NEED FOR MARINE MONITORING

Europe's commercial operators in the maritime sector – in shipping, fishing, oil exploration, offshore construction, aquaculture, tourism development, coastal protection, defence, search and rescue – as well as those researching into the functioning of our planet have a common hunger for information on the past, present and future meteorological, oceanographic, hydrographic and ecological state of seas and oceans. This paper examines why they need this information and how these needs are currently being met. It then goes on to outline possible actions at an EU level that might improve matters and indicates the economic benefits that might then accrue.

1.1. Global scale

The objective of monitoring the ocean is to measure its present and past state and forecast its future behaviour.

Europe needs guaranteed access to a monitoring system that is global in scale firstly because global phenomena have a local impact and secondly because the EU has international interests and responsibilities.

The interconnectivity of oceans and the relationship between oceanic dynamics and atmospheric behaviour are well known. The North Atlantic Oscillation (NAO) is associated with winter fluctuations of temperatures, rainfall and storminess over much of Europe. Observations indicate a link between this oscillation and North Atlantic sea surface temperatures. Interdecadal oscillations in North Atlantic ocean temperatures are reflected in the mildness or severity of Europe's seasons[1]. Europe is presently warmed by the northward transport of heat from the Caribbean in the surface layers with a compensating southward flow at depth - the Atlantic Meridional Overturning Circulation or Atlantic conveyer. It is conceivable that global warming might abruptly establish new and different patterns bringing dramatic local impacts[2]. The primary uncertainties in measuring sea-level rise in Europe are the rate of melting of ice-caps in Greenland and the Antarctic.

However, the EU is interested in global phenomena not only because of their local impacts. If it aims to increase its voice on the world stage it will need access to information on a global scale for its own sake.

According to the Commission's 2005 review of its sustainable development agenda[3] "the decision in Gothenburg to ensure yearly monitoring of the sustainable development strategy at the Spring European Councils has fallen short of expectations……more effort will also be put into developing future models, forecasts and further gathering of scientific data to help effective monitoring".

---

1 Sutton R.T, and D. L. R. Hodson, 2005, "Atlantic Ocean Forcing of North American and European Summer Climate". Science Vol. 309 (1 July 2005)

2 Quadfasel D., 2005, "Oceanography: The Atlantic heat conveyor slows". Nature Vol. 438, 565-566 (1 December 2005)

3 Communication from the Commission to the Council and the European Parliament "The 2005 Review of the EU Sustainable Development Strategy Initial Stocktaking and Future Orientations" COM(2005) 37 final

Furthermore the EU has exclusive competence in international relations in the domain of fisheries. It is empowered, on behalf of its Member States, to undertake international agreements with third countries or international organisations in this domain. Negotiations are increasingly taking account of the EU's commitment to sustainable development and the legitimate aspirations of developing States to develop their fishing industry. At present the reliable data to support these commitments is patchy or non-existent.

For these reasons, Europe needs guaranteed access to a monitoring system that is global in scale.

1.2. Regional scale

For a more detailed understanding of sea behaviour and ecosystem functioning, there is a wide consensus that a regional approach, combining the efforts of all the coastal states and meeting the specific needs of stakeholders adjoining particular water, is best. Fish stock assessments are currently made in regional working groups, often under the auspices of an organization such as the International Council for the Exploration of the Sea (ICES). Regional sea conventions such as the Helsinki Convention (HELCOM) for the Baltic, OSPAR for the North East Atlantic, and Barcelona for the Mediterranean have established joint programmes, common procedures and regular reporting for environmental quality.

Since some fish-stocks, such as North Sea cod, are shared with non-EU nations and since the coastlines of some seas – notably the Mediterranean, are only partially made up of EU members, these stock assessments and regional strategies require collaboration with non-EU countries.

And, whilst regions can be chosen to reflect natural boundaries, they are part of a global system connected by winds, currents and migratory species. Fish cross national territorial or jurisdictional boundaries to spawn or feed. The epic journeys of species such as salmon and eels, for instance, are natural wonders. Careful coordination between regions is needed to ensure compatibility between regions and with the larger scale global approach.

1.3. Timescales

The relevant timescales for different stakeholders vary vastly. Climatologists look for differences over decades, centuries or millenia. Marine fisheries or environmental protection managers generally monitor year to year variations whereas those concerned with coastal protection need weather forecasts for the next day.

1.4. The importance of long time-series of data

However all scientists base their analyses on observations of the natural world. The simulation models they build and operate for predicting the impact of climate change on sea-levels, for planning off-shore structures or for calculating sustainable fisheries catch limits rely on long time-series of measurements to calibrate and validate hypotheses and assumptions. Oceanic systems that do not exhibit changes from year to year are the exception rather than the rule. Even without any human interference, rhythms, cycles and oscillations would continue in ocean temperatures, currents and species populations. Detecting the impact of human activity against this continually evolving background requires years of careful measurements. The impact of a change - the introduction of a marine protection area or the reduction of a pollution input - can only be detected if the behaviour of the system before the change is understood.

There are a number of examples of this. A recent analysis of the influence of the Atlantic subpolar gyre on the thermohaline circulation concluded that the results highlighted "the key importance of long and continued observational time series".[4] The Commission's Scientific, Technical and Economic Committee of Fisheries found it difficult to provide a quantitative assessment of the effectiveness of the Shetland box in predicting biologically sensitive demersal species because of scarsity of data previous to its establishment[5].

2. PRESENT OPERATIONAL MONITORING

2.1. National efforts

A number of organisations with responsibilities for increasing scientific understanding of the oceans as well as those with more targeted objectives such as forecasting weather, protecting coastlines or assessing fish stocks are already engaged in the collection and distribution of measured and processed data. Both civilian and military bodies have some responsibilities for this data.

Member States monitor their own waters for pollution and tides. Research vessels, moored and drifting buoys, profiling floats and satellites measure temperature, salinity and currents from the equator to the poles. Fishing nations conduct scientific surveys - calibrated trawls, acoustic soundings, egg and larvae samplings and video surveillance. Data on fishing - landings, effort - are collected by the flag state and by the port of landing of the vessels concerned.

2.2. European integration

Collaboration between nations in individual sectors is already well advanced.

The European meteorological community is well integrated through organizations such as the European Medium Range Weather Forecasting Centre (ECMWF) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and networks such as the Network of European Meteorological Services (EUMETNET).

European Framework Programme projects such as SEA-SEARCH have developed common access points to meta-data held by national oceanographic institutes. Its successor, SEADATANET, which will network together data producers to provide distributed access to marine data, will enter into the implementation phase shortly.

---

4 Hjálmar Hátún et al., 2005. "Influence of the Atlantic Subpolar Gyre on the Thermohaline Circulation". Science Vol. 309 p. 1841-1844. (16 September 2005)

5 19th report of the scientific, technical and economic committee for fisheries Brussels, 01-05 November 2004, SEC(2005) 369

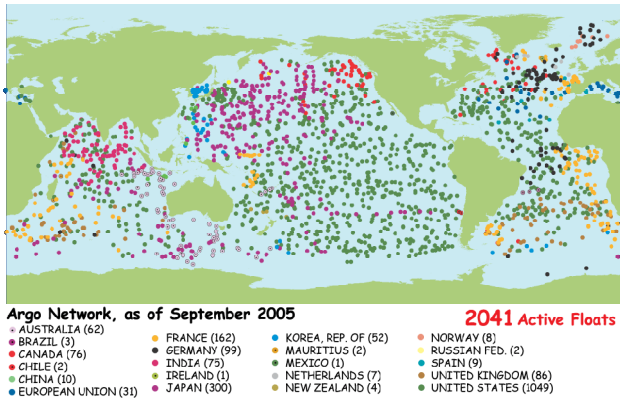

Figure 1 Argo buoy network. Individual nations cooperate to provide in-situ measurements of temperature, salinity, and drift.

A network of 3,000 Argo floats will provide global measurements of temperature and salinity over the top 2000 metres of the ocean and currents at 1000 metres depth. Various national Argo programmes cooperate and coordinate their efforts in building the Argo array, which is presently over two thirds complete (Figure 1). All Argo data are made freely available both in real-time and, after scientific quality control, delayed-mode. Subsurface data from the Argo array are already being used by operational ocean forecasting centres, to measure the sea-state directly and to provide input to ocean circulation models. Researchers are exploring how this improved knowledge of subsurface conditions can improve medium-term and seasonal weather forecasting.

An increasing number of national fishery surveys are integrated into multinational wide area surveys such as the North Sea International Bottom Trawl survey, the North Sea herring acoustic surveys, mackerel and horse mackerel egg surveys. Coordination and integration is facilitated by international working groups – both survey-type-specific or area-specific. The Data Collection Regulation[6] specifies how Member States should collect data on parameters such as catches, landings, age distributions and effort in order that stocks can be assessed. Work is ongoing to check the quality of the data supplied and to accelerate the transfer of information to the scientists who need it.

The INTEREG III Community initiative, financed by the European Regional Development Fund, which aims to stimulate interregional cooperation in the EU, has supported pilot projects on spatial planning and habitat mapping – the BALANCE[7] project in the Baltic and the MESH[8] project in Northwest Europe.

And, as well as providing a forum and framework for the international scientific community to assess fish stocks in northern and western waters on behalf of the European Commission, ICES provides technical and scientific advisory support to the regional sea conventions for marine environmental protection.

---

6 Council Regulation (EC) No 1543/2000 of 29 June 2000

7 See: http://geus.net/balance/

8 See: http://searchmesh.net/

2.3. Further European and international initiatives

A number of other moves are underway to improve still further the collaboration on a national, regional and global scale. Through the INSPIRE[9] initiative the Commission has proposed that spatial data held by Member State public authorities - including oceanographic data such as currents, salinity and wave heights - should be easily accessible to the public authorities of other Member States as well as the institutions and bodies of the Community.

Through its Marine Strategy the Commission proposed that Member States' monitoring of territorial and other waters under their jurisdiction become mandatory and formalised within a regional framework. This would involve a coordinated marine programme for each region or sub-region with regional objectives, standardized protocols and regular reporting. The monitoring and assessment systems would be consistent with those of other existing instruments, such as the Water Framework Directive, where it applies in coastal and marine waters. The cost is met by the Member States themselves.

NATO cooperation activities in military oceanography (MILOC) cover their specific demands but many of their requirements, such as rapid environmental assessment, are identical to civilian ones.

At a global level both the Commission and the EU Member States have committed themselves to the Global Earth Observation System of System (GEOSS) 10-year Implementation Plan in February 2005[10]. This should produce a distributed system of systems. GEOSS has been accepted as the appropriate framework for global monitoring. It should coordinate the deployment of in-situ and space observation systems, promote the exchange of data and act as a promoter for data standards. The end product should be a distributed system of systems comprising better-coordinated, harmonised data and interoperable services.

The Global Monitoring for Environment and Security (GMES) initiative, which is supported by the European Space Agency and by the European Union's Framework Programme for research, aims to developing operational information services addressing global to local scales, and using space and in situ observations. Monitoring and forecasting physical and ecosystem characteristics for the global ocean and the European seas has been identified as a core GMES service. Research and development projects including MERSEA are underway to implement an integrated European service capacity for global and regional hindcasting, nowcasting and forecasting, as well as for reanalyses of long time series. These will include physical oceanography as well as transport of ecologically significant material. Moreover, several ongoing GMES projects, such as OCEANIDES, MARCOAST and Polar View, have already contributed to the development of downstream services dedicated to the monitoring of oil spills, harmful algae, and polar sea ice.

With the Sentinels initiative, the European Space Agency (ESA) has gathered operational requirements for the global and regional monitoring of the marine environment. Current plans are that a series of satellites will provide 20 years of measurements on sea surface topography and significant wave height as well as sea surface temperature and ocean colour. The first of the Sentinel-3 series is scheduled for launch in 2011-2012. Its principal payload will consist

---

9 Proposal for a Directive of the European Parliament and of the Council "Establishing an infrastructure for spatial information in the Community (INSPIRE)" Brussels, 23.7.2004 COM(2004) 516 final.

10 At the Third Earth Observation Summit held in Brussels, Belgium, on February 16, 2005:

of an ocean and sea-ice monitoring altimeter and optical and infrared radiometers which will ensure continuity with the MERIS and AATSR instruments on Envisat. Sentinel-3 will be complemented by the Sentinel-1 series with its Synthetic Aperture Radar for operational ice services, oil spill monitoring and vessel surveillance capabilities. Both series of operational Sentinels will complement missions of EUMETSAT and international partners.

2.4. Increasing need for communication between sectors

The barriers between the separate disciplines are breaking down at the same time as those between countries. The Common Fisheries Policy is committed to an ecosystem approach which will include taking more account of by-catches of non-commercial species or assessing damage to seabeds from trawling. Physical oceanographers are beginning to include nutrient transport and primary production into their models. There are obvious strong couplings between oceanography and meteorology so it is not surprising that some of the benefits of cooperation in meteorology have spilled over into oceanography. For instance the European Centre for Medium Range Weather Forecasting provides a global data set for wave heights.

3. CHALLENGES: NEED FOR A EUROPEAN NETWORK

Despite this progress, there is a consensus that the present system is still too fragmented. Researchers and service providers still cannot access the available data easily.

Although ongoing efforts, mostly through ICES, are creating integrated repositories of fisheries survey data, other data are held within the confines of national laboratories. Oceanographers have become accustomed to collecting data for parameters such as sea surface temperatures or the North Atlantic Oscillation Index from United States sources - even for European seas and for data derived from European bodies - because their databases are less fragmented and easier to interrogate.

Much of the EU-level support to programmes for improving long-term monitoring, interoperability and data access is provided through mechanisms that are inappropriate, short-term or where the final users have difficulty in making their voice heard. Quality checks of data and information produced are informal and insufficient. The instruments of the EU's Framework Programme, which support many of the initiatives, are designed to promote new ideas and innovation rather than collect routine measurements.

Emphasis is on protecting intellectual property rights of project partners rather than ensuring that data collected is made available to the wider scientific community. This policy started with a Council decision for the Fifth Framework Programme and remained in force for the Sixth. There are, as yet, no plans to change it for the Seventh.

4. POSSIBLE ACTION BY EU

Moving from the current patchwork of activities with scattered data collections, heterogeneous data formats, uncertain access rights and sporadic monitoring will require extra effort over and above that already planned. The overlap of activities by fisheries, environmental, defence, oceanographic and meteorological organizations risks duplication of effort. Measuring the state of the oceans and forecasting their future condition requires observation systems that are accessible, sustainable, stable and reliable.

Gathering the present fragmented structures into this integrated European monitoring and observation strategy could be achieved by an action plan that would address the present structural difficulties at a global, regional and Member State level. The plan would aim to clarify responsibilities by developing a roadmap to provide clear institutional mandates, agreed targets and the means to achieve the objectives.

A possible way to achieve these objectives is outlined here. The EU should consider setting up a European Marine Observation and Data Network which could provide a sustainable focus for improving interoperability and increasing access to data. This should not be considered as a blueprint but rather a demonstration that the present difficulties are not insurmountable and that solutions do exist. This document should be considered as the first step in a consultation process.

4.1. Levels of processing and services

The data required to answer scientific or operational questions can be broadly and imperfectly divided into three levels of services:

(1) raw measurements from acoustic soundings, samplings, buoys, satellite sensors, etc.

(2) systematically processed information such as biomass estimates or ocean circulation data at a regional scale.

(3) information produced to answer specific questions. What is the cod stock in the Kattegat? When will an oil-slick reach the shore? When will ice melt in the Baltic next year?

There are of course no hard and fast rules for deciding exactly what level of processing should be applied to second-level data and what is more appropriate for the third level. This will depend on the budget available and the priorities of stakeholders. However the basic principle is that the Network should not directly aim to provide made-to-measure solutions that meet the needs of specific end-users. These should be provided by the market and paid for by the end-user. Rather it should provide the accessible, sustainable, stable and reliable foundation that will make the basic data and information required available to a wide spectrum of public and private bodies, according to their requirements, thereby enabling policy issues to be addressed, scientific questions to be answered and public and commercial services to be provided.

4.2. The European Marine Observation and Data Network.

The tasks of the European Marine Observation and Data Network could be:

(1) to facilitate the systematic and operational long-term collection of data necessary to understand biological, chemical and physical behaviour of seas and oceans;

(2) to encourage the interoperability of data collected by different regions;

(3) to ensure the quality of the data;

(4) to process operationally the raw data into information that is usable by service providers and researchers;

(5) to render the data easily accessible;

(6) to provide a repository for data collected in EU-funded projects.

The Network would facilitate the work of researchers dealing with climate change, ecosystem health, fisheries management, and coastal protection. It would open opportunities for operators to provide value-added services or the maritime industry and governmental bodies. These services include the assessment of ecosystems, the prediction of climate, the compilation of environmental indicators, the construction of offshore facilities and the planning of coastal defences.

4.3. Strengthening and widening mandate of existing institutions

The Commission's proposal for the Marine Strategy suggests that the Marine Conventions (HELCOM, OSPAR, etc.) could act as focal points for reporting at a regional level. The further work to ensure interoperability and facilitate data access will benefit the EU as a whole and should be supported at EU level. Their present mandate covers the "marine environment". Effort needs to be spent in determining how to integrate their work with those responsible for monitoring fisheries and physical parameters.

EUMETSAT already provides continuous meteorological observations from space to a large user community. Its Convention was amended from November 2000 to include operational climate monitoring and the detection of climate changes. So it implicitly covers oceanography. Its Jason-2 altimetry programme contributes to an international ocean surface topography mission.

Explicitly including satellite measurements of the oceans within the mandate of EUMETSAT appears logical but would require careful negotiation and possibly some changes in the governance of EUMETSAT whose Council is presently made up of representatives of the national meteorological offices of its members.

4.4. Sustainability and long-term commitment

Identifying responsibilities, promoting standards and harmonising technologies are necessary but insufficient conditions for the sustainable long-term solution needed to understand the oceans. Guaranteeing the quality, completeness, continuity and accessibility of the information will require a proper legal basis, binding commitments and dedicated funding.

The Common Fisheries Policy already provides a legal basis and sustainable financial support for data collection in fisheries. The EU should in addition consider modifying the rules of research projects it finances. Access to the data they generate that can benefit the public good should be guaranteed. This might be a first step in persuading Member States to do likewise.

However regional integration, harmonization, data archiving and access bring additional costs that are presently being partly met on a short-term ad-hoc basis. Changing this to a long-term commitment requires the creation of a more appropriate financial mechanism.

Monitoring the ocean at a global scale adds another dimension and requires different solutions. Shifting the present monitoring programmes of Member States into an obligation is not being considered as an option. To make significant progress needs firstly extra finance at an EU level to supplement the individual monitoring efforts of the Member States, secondly support for the same data assimilation, integration and access at a global level that is needed

at a regional level and thirdly the creation of a stronger European voice in discussions with international partners concerning shared responsibilities and access rights.

4.5. Access to data from EU-funded efforts

4.5.1. Framework Programme Research

Whilst the overall policy of the Framework programme is to favour intellectual property rights rather than a public dissemination of data, data from observations of the oceans might be considered as deserving of an exemption. In any case, some consortia already have no objection to making their data available for posterity but there are no guidelines or mechanisms for helping them to doing so. There is no guidance on data formats and no Community website giving access to data from old projects. Researchers have other priorities and, because many researchers work on short-term contracts, may well leave an organisation once a project has ended. It has proved very difficult to retrieve the information from completed projects. The Network should facilitate maintenance of data and access to it.

4.5.2. Common Fisheries Policy

Under the Data Collection Regulation, the EU provides financial support for the collection of fisheries data – catches, effort, biological samplings, surveys, etc. - by Member States for scientific purposes. The parameters to be collected and the formats in which they are to be supplied are specified in detail. This facilitates the assembling of data from different Member States and the building up of a complete picture of EU fisheries.

These data are accessible to the Commission in an aggregated form and can be held for up to 20 working days. A number of Member States authorities have identified a number of safeguards that might facilitate their assent to making the data more widely available and at a lower level of aggregation. These include (1) allowing time for researchers who collect data to publish results before they become officially available, (2) making sure that those who use the data inform the data providers so as to prevent misuse or misinterpretation and (3) granting anonymity for the fisherman who provide data on practices such as discarding. A revision of this Regulation planned for 2007 aims to establish the principle of greater access to data by the Commission, by regional fisheries organisations and by the research community whilst taking into account these concerns.

The Network should facilitate the integration of fisheries data with other data.

4.6. Funding options

The Commission has already proposed a financial perspective for 2007-2013. This is still being discussed by other EU institutions and may well change but any action proposed might need to fall within the global envelopes proposed there.

Some of the necessary funding for a Network might come from the EU's research and development budget. Whilst not directly producing innovative results, it will provide a value-added infrastructure that allows researchers from Member States to work more efficiently and concentrate on the interpretation and analysis of data rather than its collection. It will reduce uncertainties in oceanographic forecasts – for instance for medium and long-term climate variability – and in ecological assessments.

However researchers will not be the only beneficiaries. Easily accessible information will provide raw material for public and commercial operators to provide services in sectors such as shipping, oil exploration, pollution control or tourism. Therefore other sources of funding – including structural funds might also be considered. Data might be considered as useful an infrastructure for development as new roads or airports. Another justification for using regional funding would be the benefit to regional institutions.

Finally, some support from external relations funding might facilitate integration of the non-EU neighborhood nations in the Mediterranean.

4.7. Management of distributed information

A number of European bodies faced with the challenge of collecting information from different sources and distributing it to stakeholders are moving away from large Europe-level databases and turning instead towards solutions whereby data is maintained at a national or regional level. This is the approach of the INSPIRE initiative and of the Data Collection Regulation in fisheries and will be followed by the European Marine Observation and Data Network. Gathering and integrating these distributed data requires agreed standards and innovative information and communication technologies. There is still some work to be done to properly assess the relative merits of alternative approaches for dealing with this challenge.

4.8. Monitoring pressures

Although this paper has focused mostly on collecting information on the state of the environment, a proper understanding of the impact of human activities on the marine environment will not be feasible without more information on the level of those human activities – e.g. shipping, aquaculture, fishing, gravel extraction, coastal development, petroleum extraction, etc.

This may require some safeguards to protect privacy and commercially sensitive information. It is for this reason that the EU's fishing fleet is not currently obliged to deliver the records from its onboard Vessel Monitoring System to scientists assessing fish stocks. However there is no reason why it could not be supplied in an aggregated form that avoids identifying individual vessels. Discussions are underway to see whether this can be done.

4.9. Organisation

The collection, processing and analysis of data will continue to be largely carried out within national organisations. National contact points and a strong secretariat will be needed to check deliverables, negotiate data access and provide a portal to the information. This secretariat will need a strong information technology expertise as well as scientists with a marine science background.

Representative stakeholders – from the climate change research community, from the European Commission, from the commercial sector, from the Regional Marine Conventions, from the European Environment Agency and from the national marine research organisations will ensure that the data meets operational needs and that the limited budget is used to bring the maximum added value to what is being done at a national level.

4.10. Relation to other initiatives

The Network proposed here will build on the proposed EU Marine Strategy by facilitating and financing access to data produced under the monitoring requirements of that strategy.

The basic data infrastructure built up by the Network will enable end-user-oriented services to be developed, such as those that are being set up under the Global Monitoring for Environment and Security (GMES) initiative. It will be of particular benefit to the marine core service which should provide real-time predictions and ocean scenario simulations.

5. ECONOMIC BENEFITS OF NETWORK

We can identify five main economic arguments for setting up a Network as proposed in this paper. Greater availability and easier access to marine data would:

(1) open up new economic opportunities for high-technology commercial enterprises in the maritime sector.

(2) improve the efficiency of public institutions including European marine research laboratories and academic bodies.

(3) significantly reduce the current uncertainty about global environmental change.

(4) bring forward the introduction of effective seasonal and multi-annual climate or weather forecasts which would be of benefit to nearly all economic activities – e.g. energy provision, agriculture, fisheries, tourism, etc.

(5) integrate a number of currently fragmented initiatives and thus enhance the usefulness.

5.1. New commercial opportunities

A number of studies[11] have highlighted the relative easiness with which commercial concerns can obtain public sector information in the United States compared to Europe and indicated the resulting benefits – particularly in high technology and high added-value sectors.

5.1.1. Provision of a Public Good

We believe that marine data, and other data that measures the health of the planet, should constitutute a public good.[12] Economists consider that public goods possess one or both of two key properties (1) the marginal cost of use is zero and (2) it is impossible to exclude an individual from the good. If a good exhibits both properties it is referred to as pure public good. It is well known[13] that the market system is often not capable of providing public goods

---

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

12 The theory of public goods was originated by Paul A. Samuelson in the 1954 (The Pure Theory of Public Expenditure. Review of Economics and Statistics 36:387-9).

13 See e.g.: H. Varian, 1984. Microeconomic Analysis. Norton.

in the socially best way - it generally underprovides them. Therefore, the provision of public goods is often entrusted to the government or similar collective organizations.

Stiglitz et al.[14] recently analysed the question of the role of government in a digital age. They suggested that public information and data are fundamentally a public good and that governments should therefore seek to make as much public information and data available on-line as is prudently possible. However, governments should exercise increasing caution as they provide more and more raw data or information since the assembly and maintenance of the data is not costless, the benefits of additional data are diminishing. Our economic rationale for the European Marine Observation and Data Network is fundamentally the same.

5.1.2. Comparison with United States

A study[15] in 2000 on behalf of the European Commission's Directorate General for Information Society indicated that Europe invested €9.5 billion per year on public information services of which a significant proportion (37% in France and 57% in the UK) was in geographical information - mapping, land registration, meteorological services, environmental data and hydrographical services. The economic value of this activity (that part of national income attributable to industries and activities built on the exploitation of public sector information) was estimated at between €28 billion per annum and €134 billion per annum. The study suggested that the corresponding exploitation of public information in the United States was much higher (Table 1) - an annual turnover of nearly €800 billion with the key industries posting annual growth rates ranging from 11 to 37 % in the previous six years. It concludes that the priority given to public access to information in the United States and the higher investment (approximately double the EU level) in its production have contributed to this flourishing information industry.

Table 1 comparison of exploitation of public sector information in EU and US in 2000 from Pira study[15]

	EU	US
Investment	€9.5 billion	€19 billion
Economic value	€28-€134 billion	€800 billion

A comparison of meteorological services provides an example. Weiss[16] in 2002 attributed the greater turnover of commercial weather services in the USA ($400 to $700 million) compared to Europe ($30 to $50 million) to the easier availability of data. Furthermore he noted that some European public operators were charging more for their raw data than they were for value–added services and that this constituted unfair competition. Charging above the virtually zero marginal cost of providing the data is economically inappropriate for government-funded services.

---

14 Joseph E. Stiglitz, Peter R. Orszag, Jonathan M. Orszag, 2000. "The Role Of Government In A Digital Age" Commissioned by the Computer & Communications Industry Association. October 2000.

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

16 Peter Weiss, 2002. "Borders in Cyberspace: Conflicting Public Sector Information Policies and their Economic Impacts Summary Report" U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service. February 2002.

It would not be realistic to expect the same market for marine information as for meteorology. However, a large number of industries are willing and able to pay for the services that commercial operators in the maritime sector could provide if they had better access to marine data.

5.1.3. Example of Corine Land Cover

An example closer to home is that of the Corine data base for European Land Cover[17]. In the eighteen months up to May 2005, nearly 5000 different users downloaded the data from the internet. Applications were in the environmental (56%), planning (18%), research (10%), agriculture (6%), education (4%), energy (2%) and transport (2%) sectors. The European Environment Agency estimated the economic value generated by these activities as being in the order of €250 million[18].

5.1.4. Uses of marine data

Most uses of marine data will only become apparent once the data starts to become more widely available. However, some are already obvious. Better seabed information is needed to locate drilling sites for petroleum extraction, assess landslide risks on continental slopes, route underwater pipelines and determine disposal sites for dredging material. The offshore and shipping industries are very interested in forecasts of waves and subsurface currents. Europe's armed forces – whether trying to hide submarines or to find them – need three-dimensional information on ocean temperature, currents and salinity: The range of sonar depends strongly on these parameters. Those developing or protecting coastlines need tidal patterns, erosion rates and sea-level rise predictions. And, although one hesitates to advocate measures that make survival even less likely for what is left of the planet's fish population, it is well known that fishermen have the financial means to pay for information that might make their operations more efficient such as phytoplankton distribution, eddies, upwellings, thermal boundaries and fish concentrations. Finally, ecosystem information will be an essential input to environmental impact assessments and to the regulation of marine resource exploitation that any new proposed commercial activity will be required to produce.

5.2. Improved efficiency of marine research

There is an almost universal opinion amongst researchers studying the environment that the amount of time spent in tracking down data collected by other researchers is too long. Marine research is no exception. The BICEPS[19] study prepared as part of the EU's Global Monitoring for Environment and Security (GMES) initiative provides a number of examples where this has been the case. For instance it notes that marine biogeochemical data are highly dispersed and generally without quality control.

---

17 Corine provides consistent information on land cover and land cover changes during the past decade across Europe. At present, the Corine land cover database covers 30 countries.

18 This was estimated by the Agency from a sample of projects/users, who downloaded the CLC2000 data within the first months after the launch. The economic value of the downstream activities that were generated for the further processing or to integrate the data in different applications. Applications included background data for navigation systems, meteorological forecasting, flight simulator, precision farming, revisions by insurance companies.

19 Wyatt, Briggs and Ryder, 2004. "Building a European capacity for environment and security" EUR21109 (2004).

Easier access to data would allow researchers to spend more time analysing their results. Their findings, being based on a greater number of observations, will be more robust. Working out the economic benefit of this would be an interesting exercise but, so far as we know, this has not been done.

5.3. Less uncertainty in global environmental change estimates

It is incontestable that the pressure of human activity on the planet is increasing at an unprecedented rate. The global population stands at over three times the level of a hundred years ago[20]. The world's annual consumption of primary energy has increased by 145% since 1965.

Coastal erosion, fish-stock depletions and eutrophication are amongst the current observed outcomes of this pressure but, in the longer term, changes due to the increasing amount of greenhouse gases on the atmosphere will almost certainly have a large impact on nearly all economic activities – on land and at sea. Efforts to mitigate or adapt to these changes are hampered by large uncertainties about their magnitude at the global level and even larger ones at regional and local levels. Indeed, according to the Association of British Insurers[21] "further studies are needed on climate change impacts where there is limited scientific consensus at present. This will enable further modelling of the financial costs arising from these effects."

The influence of the ocean on the global and local impacts is undisputed. It is likewise accepted that uncertainties in predictions can only be reduced with better data – more coverage, longer time-series and cross-validations. The benefits from this alone would justify a European marine observation and data network.

5.4. Seasonal weather forecasting

Benefits will also accrue from reducing uncertainties on shorter timescale processes. The economic benefits of better seasonal forecasting in sectors such as agriculture, energy, transport and tourism are obvious but most research on the linkage between ocean monitoring and seasonal forecasting has been in areas affected by the El Niño Southern Oscillation where the coupling is stronger. However a number of ongoing and completed European research projects – DEMETER, ENSEMBLES, ENACT - have attempted to identify how seasonal forecasting can be improved in areas more influenced by the North Atlantic. So far the sensitivity of seasonal forecasts to subsurface ocean temperatures and other ocean features has not been demonstrated conclusively but this is more likely due to shortcomings of the models and data rather than the absence of an influence. In any case further research on the subject will benefit from access to the sustainable long-term monitoring effort that the proposed Network would foster.

5.5. Integrating short-term projects

The need for a more integrated effort on marine monitoring and data collection and the appropriateness of action at EU level has been recognized for some time. Indeed projects that have been funded under the EU's Research Framework Programmes include networks for

---

[20] 5.9 billion in 1998 compared to 1.7 billion in 1900 according to the United States Census Bureau. 6 billion in October, 1999 according to the UN population division.

[21] Association of British Insurers. Financial risks of Climate Change. Summary report June 2005

ocean and marine data management and gateways to oceanographic data, development of systems for marine data interoperability and harmonised reporting systems.

The common objective is to facilitate sharing of marine information. The partners in many of these projects are the same. In some cases the projects are concurrent – in others there is a transition from one project to the next. The European marine observation and data network would integrate these projects and become their permanent legacy. A proportion of its cost would not therefore be new but rather a redirection of existing funding. The setting aside of a budget specifically for data collection and monitoring activities would clarify its separate status from new research and render the process more transparent.

6. NEXT STEPS

There has already been some consultation with stakeholders during the preparation of this paper and there is general agreement that what is being proposed here could provide a substantial added value to what is already being done at a national level. However the proposal needs developing further.

Taking into account the input that should result from the consultation phase following the release of the Green Paper, the Commission might consider setting up a dedicated task force charged with:

(1) Mapping out more completely the past and present activities in monitoring and data collection – what has been done? What lessons have been learned?

(2) Suggesting the resources needed for the Network and clarifying the budget line or lines that could support the EU's contribution.

(3) Developing proposals for a management structure and decision making procedures.

(4) Suggesting a possible structure including a secretariat and contact points in Member States.

(5) Developing a timescale with milestones to progressively achieve the goals.

APPENDIX – GLOSSARY OF ACRONYMS

The intention, in preparing this document, was that the meaning of acronyms used in this document could be determined from context. This appendix provides some additional details. It should not be considered an exhaustive description of the organizations, projects, concepts and networks represented by the acronyms used in this report but rather a guide to further investigations with internet search engines such as Google.

AATSR	The Advanced Along-Track Scanning Radiometer (AATSR) is a space-borne instrument primarily designed to measure global Sea Surface Temperature to the high levels of accuracy and stability required for climate research and modelling. It is the third in the ATSR series, and is a payload instrument on the European Space Agency's ENVISAT,
BALANCE	Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning" – is an INTERREG III B co-funded project aimed towards development of informed marine management tools for the Baltic Sea based on spatial planning and cross-sectoral and transnational co-operation.
Barcelona	The Barcelona Convention of 1976, amended in 1995, and the Protocols drawn up in line with this Convention aim to reduce pollution in the Mediterranean Sea and protect and improve the marine environment in the area, thereby contributing to its sustainable development.
CORINE	An ongoing initiative providing data on land cover in 15 EC member states and other European and North African countries, using 44 classes. The European Environment Agency maintains the aggregated European dataset for Corine land cover. Individual national datasets are held by National Reference Centres.
DEMETER	Fifth Framework Progamme project developing methods predicting ocean-atrmosphere coupling.
ECMWF	European Medium Range Weather Forecasting Centre based in Reading, England is an independent international organisation supported by 26 European States.
EEA	European Environment Agency based in Copenhagen, Denmark
ENACT	Fifth Framework Programme project aiming to improve and extend ocean data assimilation systems, and apply them to produce global ocean analyses over a multi-decadal period and quantify the benefits of the enhanced assimilation systems through retrospective seasonal climate forecast and through analysis of ocean behaviour in a multi-model framework.
ENSEMBLES	Sixth Framework Programme Integrated Project that aims at constructing scenarios of future climate change with ensemble simulations of Earth-System Models addressing different applications, timescales, spatial scales

	and plausible future world developments to provide improved policy-relevant climate change assessment and advance our knowledge on the climate system
ENVISAT	European SpaceAgency satellite launched in march 2002 for supporting earth science research and allowing monitoring of the evolution of environmental and climatic changes
EUMETNET.	The Network of European Meteorological Services. Organises co-operative programmes between the Members in the various fields of basic meteorological activities such as observing systems, data processing, basic forecasting products, research and development, training
EUMETSAT	European Organisation For The Exploitation Of Meteorological Satellites. operational satellite Agency for European Earth Observation Programmes in the fields of meteorology.
GEOSS	Global Earth Observation System of Systems. GEOSS is envisioned as a large national and international cooperative effort to bring together existing and new hardware and software, making it all compatible in order to supply data and information at no cost.
GMES	The European Union-European Space Agency 'Global Monitoring for Environment and Security' (GMES) represents a concerted effort to bring data and information providers together with users, so they can better understand each other and make environmental and security-related information available to the people who need it through enhanced or new services.
HELCOM	HELCOM is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area" - more usually known as the Helsinki Convention.
ICES	International Council for Exploration of the Sea. Copenbagen based organization that coordinates and promotes marine research in the North Atlantic. This includes adjacent seas such as the Baltic Sea and North Sea.
INTERREG-III	is a Community initiative which aims to stimulate interregional cooperation in the EU between 2000-06. It is financed under the European Regional Development Fund (ERDF)
MARCOAST	European Space Agency GMES project to develop services based on satellite data for water quality monitoring, coastal land mapping, coastal hydrodynamics and coastal indicators.
MERIS	MERIS (Medium Resolution Imaging Spectrometer) is a fine spectral and medium spatial resolution satellite sensor and is part of the core instrument payload of Envisat, the European Space Agency's (ESA) environmental research satellite, launched in March 2002. It is designed primarily for ocean ('MER') and coastal zone remote sensing.

MERSEA	an integrated project funded through the Sixth Framework Programme aiming to provide an integrated service of global and regional ocean monitoring and forecasting to intermediate users and policy makers in support of safe and efficient offshore activities, environmental management, security, and sustainable use of marine resources. The system to be developed should be a key component of the Ocean and Marine services element of GMES (Global Monitoring for Environment and Security).
MESH	Development Of A Framework For Mapping European Seabed Habitats. MESH is an international marine habitat mapping programme that started in spring 2004 and will last for 3 years. A consortium of 12 partners gained financial support from the EU INTERREG IIIB fund for this international programme
MILOC	Military oceanography. This is the study of oceanographic conditions, ranging from temperature and salinity to tidal movements and coastal features, which can have a bearing on maritime operations
NAO	North Atlantic Oscillation. A large-scale mode of natural climate variability having large impacts on weather and climate in the North Atlantic region and surrounding continents.
OCEANIDES	A completed Fifth Framework Programme GMES project assessing the quantity and impact of marine oil spills
OSPAR	The 1992 OSPAR Convention is the current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. It combined and up-dated the 1972 Oslo Convention on dumping waste at sea and the 1974 Paris Convention on land-based sources of marine pollution. The work under the convention is managed by the OSPAR Commission, made up of representatives of the Governments of 15 Contracting Parties and the European Commission, representing the European Community
POLARVIEW	EU-Canada GMES project aiming to develop earth observation services and products for environmental monitoring and safety for the polar regions.
SEADATANET	A Sixth Framework Research Project aiming to develop a Pan-European infrastructure for Ocean & Marine Data Management started on 1 April 2006
SEA-SEARCH	Fifth Framework Programme project (2002-2006) aiming to provide users with a central overview of ocean and marine data & information, collected and managed by research institutes, monitoring agencies and data holding centres in the countries bordering the European seas. Succeeded by SEADATANET.

SENTINEL	A set of satellites to be launched by the European Space Agency as part of the Global Monitoring for Environment and Security initiative. Sentinel-3 is primarily designed for ocean monitoring. Its principal payload is an ocean-monitoring altimeter and an optical and infrared radiometer, will follow on from the Meris instrument on Envisat and is scheduled for launch in 2011-2012.