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A sea change for ocean management

A European strategy for marine
and maritime research



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**A sea change
for ocean management**
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The beauty and mystery of the oceans have captivated the human imagination since the beginning of time. Their vast depths and teeming marine life have provided us with abundant food and raw materials for millennia. But this bounty is not limitless, and coordinated action is now imperative if we want current and future generations to continue to benefit from them.



INTRODUCTION

The sheer size and unexplored depths of the ocean have encouraged us to believe it can withstand limitless exploitation. We are now realising this is not true. Since the 1950s, man's exploitation of the ocean for economic gain has caused more damage than in the previous 10 000 years, raising widespread concern for the sustainability of these developments. We therefore face a difficult paradox: we must strive to repair the damage we have caused while continuing to reap what the ocean can offer us – food, jobs, the potential for alternative energy sources such as wind and wave power, rich seams of unexplored mineral resources, and the exciting new science of biotechnology.

Science and technology have a vital role to play in the preservation of the marine environment. This brochure describes the many ways in which a whole spectrum of people involved in the marine and maritime industries – scientists, researchers, business entrepreneurs and employees, technologists, marine biologists and geologists – are fruitfully working together in international and European funded research projects using science and technology to find ways to both mitigate ocean damage while continuing with a programme of sustainable development.

In the past five years, a series of initiatives has driven the momentum for an integrated marine and maritime research policy in Europe. In 2004, the Galway Declaration¹ asked for recognition by all Member States of the oceans' crucial role in climate and the carbon cycle. It stated that science and technology have an important part to play in helping Europe achieve its Lisbon Agenda goal of making Europe 'the most competitive knowledge-based economy in the world', based on the application of science and the principles of sustainable development.

Further resolutions have evolved from the Galway Declaration. The Aberdeen Declaration² was passed at a conference in 2007 where the scientific community called for more integration in research, especially between the marine and maritime sectors. In the same year, another step forward was taken in the European Commission's Communication on an 'Integrated Maritime Policy for the European Union'³, which laid out a programme that called for Europe to seize all opportunities that our oceans can offer to generate growth and jobs, while acting in a sustainable manner.

In September 2008, the European Commission's Communication on 'A European Strategy for Marine and Maritime Research'⁴ took this a stage further by laying out an action plan for better integration of research between the maritime and marine communities in order to address the problems of marine degradation caused by human activities and develop new technologies for sustainable development of maritime activities. This brochure is based on that communication and explains the context behind its creation and some of the proposed actions and initiatives that will be carried out in the coming years.

A CHALLENGE OF UNIQUE PROPORTIONS

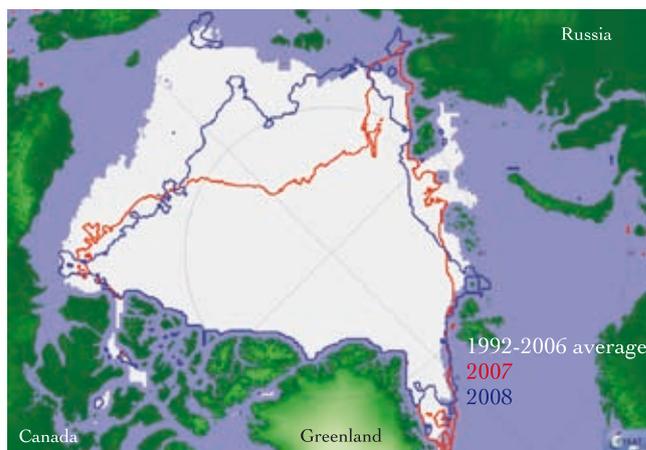
The maritime sector is of vital importance to every EU citizen. Millions of people make their living from the EU's waters and coasts, including fishermen, aquaculture farmers, tourism workers, shipbuilders, sailors and oil rig workers, to name just a few. Maritime industries provide jobs and prosperity, produce an annual income of billions of euros and generate around 5% of the EU's gross domestic product (GDP).

The maritime industries are currently facing many challenges, including the necessity of renewing fishing and transport fleets and expanding aquaculture to produce more fish to feed the growing population. We also have the opportunity to increase our knowledge of the millions of life forms – mostly untapped at present – that thrive in the deep ocean and which have the potential to offer untold benefits to humans in the form of new products for industry, pharmaceuticals and the food sector.

But at the same time that our need to tap the ocean's wealth is increasing, we are also facing a marine environmental challenge of unique proportions. We have spent the past decades over-exploiting the oceans to develop our economies and feed our growing populations, and this has extracted a high price. Increased pollution, the degradation of marine ecosystems, overfished seas and disappearing biodiversity are all a result of overambitious and often badly managed human activities.

Ocean pollution is now such a serious problem that it is affecting all aspects of marine life. Acidification of the ocean, which has been caused by the increase in carbon levels due to the burning of fossil fuels, has altered the pH balance of the ocean faster in the past few decades than in the last 300 million years. Acidification has potentially devastating implications for the ocean and the whole of the marine food chain, as it is causing a reduction in the levels of calcium carbonate, a material that many marine species, including shell fish and star fish, need to build their shells and skeletons.

Sea ice depletion



In September 2007, the ice in the Arctic (red line in the above picture) covered an area of only 4.2 million km² – a record low. This represents a loss of an area of ice the size of Austria, Belgium, France, Germany, Italy, Spain and Switzerland combined, compared to the period from 1992 to 2006 (white area). In 2008, the second-lowest Arctic sea ice cover was observed (blue line). That year also marked the first time since satellite measurements have existed that both the North-West (north of Canada) and North-East (north of Russia) Passages were free of ice at the same time.

Large stretches of our ocean run the risk of turning into 'dead water zones', areas that can no longer sustain life, not just because of acidification, but also because of chemical pollution, primarily nitrogen and phosphorus, from industry and agriculture. These waters produce toxic algae that consume the available oxygen, killing off all other life forms, including plankton, a crucial source of food for fish.

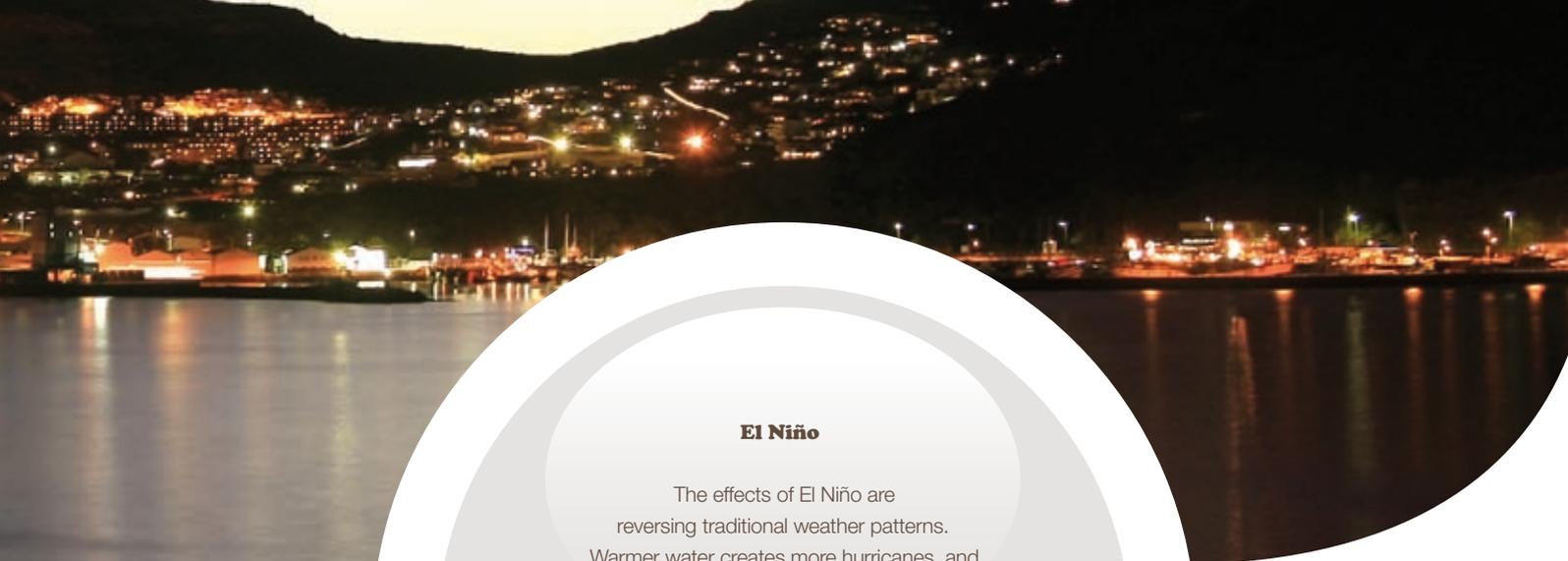
Pollution from industrial shipping, ferries and cruise liners is also causing problems in the ocean as these vessels dump thousands of tonnes of industrial waste and sewage every year. Shipping activity also raises the concern of introducing 'invasive species', fish and micro-organisms that are caught in ships'

Shipbuilding
EUR 13 billion annual turnover/500 000 workforce

Transport
EUR 20 billion annual turnover/350 000 workforce

Fisheries and aquaculture
EUR 20 billion annual turnover/500 000 workforce

Marine tourism
EUR 72 billion annual turnover/3 million workforce



El Niño

The effects of El Niño are reversing traditional weather patterns.

Warmer water creates more hurricanes, and unusually heavy rainfall across the equatorial coasts and the north of Peru has led to flooding and landslides.

Conversely, drought in Indonesia has led to starvation.

Attempts to collect data on El Niños have been hampered for a long time by lack of communication between the relevant experts involved, such as meteorologists, oceanographers and geologists. Now, scientists and researchers from different disciplines are starting to work together, and have created a model to predict climate changes associated with El Niño. Through joint research, pieces of the pattern are slowly starting to be identified.

ballast water and then released, often hundreds or thousands of miles from their natural habitats, causing disruption to local ecosystems.

Tackling all these problems is an enormous challenge that will require major strategic cooperation in the coming years between everyone working in the fields of marine and maritime research. All forms of ocean life depend on each other and this complex interdependency needs in-depth multidisciplinary study and research if we are to halt, or even mitigate, the present effects of our exploitation of the seas.

The ocean and climate work in harmony through an extraordinary symbiosis of reactions. To fully understand this complex relationship, much more interdisciplinary maritime research and cooperation needs to take place in the fields of biology, chemistry, physics, geology, ecology, and meteorology, to find the best ways of preserving the ocean environment while still benefiting from it.

Fighting 'red tides' needs joint research

Harmful Algal Blooms (HABs), also called 'red tides', often impact as discoloured water, due to the high densities of millions of microscopic algal cells in seawater. Some species can be highly toxic, even at considerably lower levels when they are invisible. HAB events, which cause enormous damage to aquaculture, the environment and tourism, are becoming more frequent. Scientists have argued that geographic expansion of some HAB species is due to their translocation in ships' ballast water where they can stay alive for a long time. HABs are the result of an entire ecosystem, and have such wide-ranging knock-on effects that a scientific approach involving all disciplines in marine and maritime research is necessary.



'Red tides' is a misnomer since discoloration is not usually visible at the surface. The picture represents the species *Dinophysis acuminata*. This phytoplankton which generates toxins is responsible for most of mussel and shellfish marketing closure days in western Europe.





A DELICATE BALANCING ACT

The range of maritime activities is increasing all the time, which will cause further stress to the ocean. The expansion of tourism, shipping and construction around coastal areas and the development of new industries such as aquaculture, off-shore wind farms and marine biotechnology are all putting further pressure on the ocean. All marine activities have their own management policies, but at present a lack of integrated data makes it difficult for scientists to measure how far one activity adversely affects another.

A new holistic approach towards marine and maritime research policy is crucial if we are to make serious progress in mitigating the negative impact of human activities on the oceans and maintaining them as a bountiful source of food and raw materials in the future. At the same time, we must ensure they once again become healthy enough to sustain further development – a delicate balancing act. Our waters are of critical importance to all Member States (22 out of 27 Member States are coastal) and the most pressing research challenges must be addressed jointly using a cross-thematic approach.

We need to concentrate on developing ecosystems-based joint policies across all different scientific disciplines and creating new research agendas that involve all stakeholders.

Change can happen. In fact, it already is. A large number of EU-funded research projects and networks are studying important subjects such as the impact on marine ecosystems of industrial activity, the impact of climate change on marine dynamics, marine technology, and exploitation of marine renewable energy.

Researchers are also being trained and educated. These Networks of Excellence and Integrated Projects all involve partnerships between universities and research institutes across many EU countries, with a sharing of data and a clear agenda of research priorities.

Reconciling maritime economic activities with the preservation of marine ecosystems is one of the major challenges of the EU for the years to come, and is the cornerstone of the European Commission's new strategy for marine and maritime research.

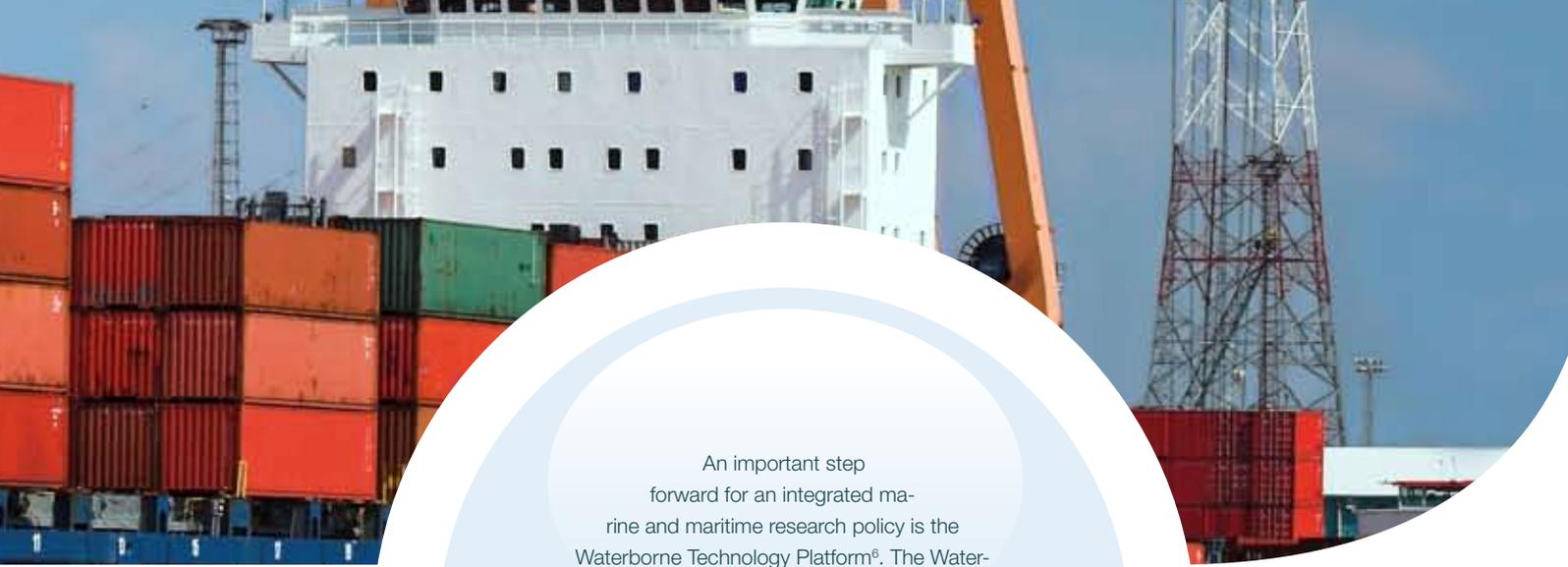
How EU-funded projects are taking action

Through its successive framework programmes, the European Union has constantly increased its support for research activities within the whole field of maritime activities: ecosystems, sustainable transport and energy, space, biotechnology and food quality and safety, to name some of the most important. Within the Sixth Framework Programme (FP6) for R&D, more than EUR 600 million of European funding has been provided towards research projects in the maritime domain⁵. The following examples illustrate how EU-funded projects are taking action.

- **SESAME** is a research project bringing together scientists from around 50 organisations with expertise in marine biology, biodiversity, physical and chemical oceanography, and socioeconomics, in order to learn more about past – and future – ecosystem changes of the Mediterranean and the Black Sea. The project also explores the abilities of these ecosystems to sustain livelihoods in tourism and fishing. Linking natural and social sciences, the project will reach decision-makers and the general public at large. For more details, please see the Internet (<http://www.sesame-ip.eu>).

A top-quality research fleet is imperative for a science-based European maritime research policy, and research vessels require a high level of maintenance. Many of the ships in the EU's current research fleet are over 20 years old and need upgrading. This will be an important priority for the new maritime research policy, and recommendations for the EU research fleet include international cooperation for cost-sharing in maintenance and rare equipment, and encouraging the co-ownership of research vessels. The EU will also seek to optimise the use of existing vessels.

- **MarBEF** is a network of 700 marine scientists in Europe, drawn from 94 institutes in 24 countries. As these scientists come from many different disciplines, the network will integrate marine research and help the dissemination of knowledge on marine biodiversity to researchers, industry, stakeholders and the public. MarBEF addresses the most topical questions in Europe with regards



An important step forward for an integrated marine and maritime research policy is the Waterborne Technology Platform⁶. The Waterborne Technology Platform has brought together stakeholders from all areas of the marine and maritime sectors, along with representatives from local and national governments, universities and research institutes (both public and private), to create a vision for the future of European maritime research using advanced knowledge and technologies. The Waterborne Technology Platform has created a Strategic Research Agenda (SRA) which prioritises research ideas that combine environmental challenges with sustainable development of the ocean.

to marine ecology, biogeochemistry, fisheries biology, taxonomy and socioeconomics. It will help to protect, restore and better use living marine resources. For more details, please see the Internet (<http://www.marbef.org>).

- **SPICOSA** is a research project with 54 partners including coastal experts, policy makers, universities, research institutes and small to medium-sized enterprises (SMEs). Partners are working together to reverse coastal degradation, improve coastal management, and help make the transition to a sustainable coastal management. To do this, they are developing tools and approaches to create new coastal management policies and to improve communication between different actors in the marine fields. For more details please see the Internet (<http://www.spicosa.eu>).

- **HERCULES** is a research project which has developed new technologies to drastically reduce gaseous and particulate emissions from marine engines and to increase engine efficiency, thereby reducing fuel consumption and CO₂ emissions. Led by European major engine makers, the 43 partners included component suppliers, equipment manufacturers, universities, research institutions and shipping companies. The project's industrial partners hold 80% of the world market in marine engines and hence are the keepers of today's best available technology. For more details, please see the Internet (<http://www.ip-hercules.com>).

This new research strategy will be based on the full integration and interaction of all the actors in the marine and maritime environments and will be underpinned by a new form of governance. The strategy will have three strands of action:

- capacity building to enable multidisciplinary research to be carried out;
- integration of all disciplines concerned;
- establishing synergies between forms of financial research support.

Capacity building is vital if we are to create opportunities for multidisciplinary research, and train scientists and researchers in multidisciplinary skills. We must invest in state-of-the-art infrastructures such as new satellite and ocean observatory equipment and high-tech computer modelling and data collection systems so we can better measure the effect on the ocean of all maritime activities. New programmes will be set up to train young scientists and researchers in multidisciplinary skills so they can work across all areas of marine and maritime research.

Integration is essential. It is needed to set up an approach to marine and maritime research that connects all disciplines. This will be achieved through EC-wide calls for research proposals involving all related research areas, based on priorities defined in the new strategy. The strategy will also pursue closer integration and more efficient use of marine databases, as well as better access to existing research infrastructures.

Establishing financial **synergies** is necessary if we want to achieve our goals. More public-private investment must be sought, as well as more innovative ways of financing research. The Seventh Research Framework Programme (FP7) and European Technology Platforms (ETPs) will be used to help build on already existing research programmes at regional, national and transnational levels.

The momentum has already been put in place with such initiatives as ERA-NET, which was created to achieve better coordination of research at local and national levels through the EU. One example is the BONUS ERA-NET project⁷, whose goal is to set up a network of agencies which fund research into science-based management of environmental issues around the Baltic Sea. In particular, BONUS has developed models for eutrophication risk assessment in the context of an integrated management of the Baltic Sea basin.



PUTTING IT ALL IN PLACE

The new marine and maritime research strategy needs to be underpinned by an innovative form of governance. This is now being set in motion with a strategy laid out by the European Commission in the shape of an ‘open forum’ for all important stakeholders from both the public and private sectors in the marine and maritime fields. They will include research institutes, scientists, universities, policy makers, representatives from local and national authorities and from maritime and marine industries and businesses. Stakeholders will be drawn from both EU and third countries.

The forum will create dynamic, flexible and sustainable long-term partnerships in which all stakeholders can meet, discuss and identify marine and maritime research priorities. In this way, synergies can be created between stakeholders from the different sectors of the marine and maritime world, and the most important environmental problems and challenges can be identified and acted upon. We need the best possible marine and maritime scientific knowledge to surmount the current challenges and this will be achieved through working together. New forms of cooperation, such as more productive ways of sharing research results and new forms of joint financing for projects, will also be investigated.

The forum will also look at ways of turning environmental challenges into competitive advantages. Such ‘eco-innovations’ could create new jobs as well as provide solutions to the current challenges.

Long-term sustained dialogue and working synergies between policy makers and scientists will enable the most important marine research results to be transformed into legislation as quickly as possible. Research priorities will be continually updated to identify gaps in research needs.

Continuous dialogue between all stakeholders will lead to a constant flow of ideas and feedback on the most up-to-date research tools and marine data, which are essential for planning research needs.

Currently, many research project results do not become widely known and therefore opportunities for positive results to be put into action are sometimes lost.

The forum will be based on networks and partnerships that are already up and running, such as those fostered under the framework programmes and the technology platforms. The European Commission will act as a facilitator to oversee the activities of the forum and will make regular reports on the progress of the strategy. There will also be an annual conference for feedback and discussion.

Strengthening research connections between the EU and third countries is an important part of the strategy because it will enable research projects to be carried out in stretches of ocean outside EU jurisdiction. This will allow the collection of a much wider range of data.

The marine and maritime research strategy represents one of the first attempts to fully establish, within a research sector, the European Research Area (ERA), which was created to expand and unify research across the EU and give scientists access to the best equipment, facilities and research institutes. If the forum proves successful, it will pave the way for other research sectors to bring together the potential of ERA methods into their research activities.

The European marine and maritime research strategy represents one of the first attempts to fully establish the ERA within a research sector

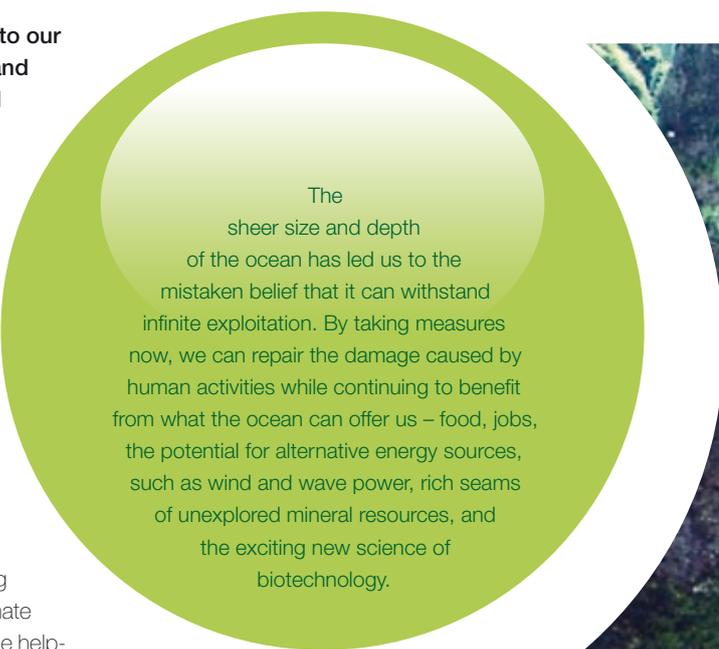


CONCLUSION

Oceans and seas are essential to our future economic welfare and well-being. They have the potential to provide great benefits to European society, but only if Europe tackles the twin challenges of integrating the governance of oceans and sea basins, and developing maritime activities in an environmentally sustainable manner.

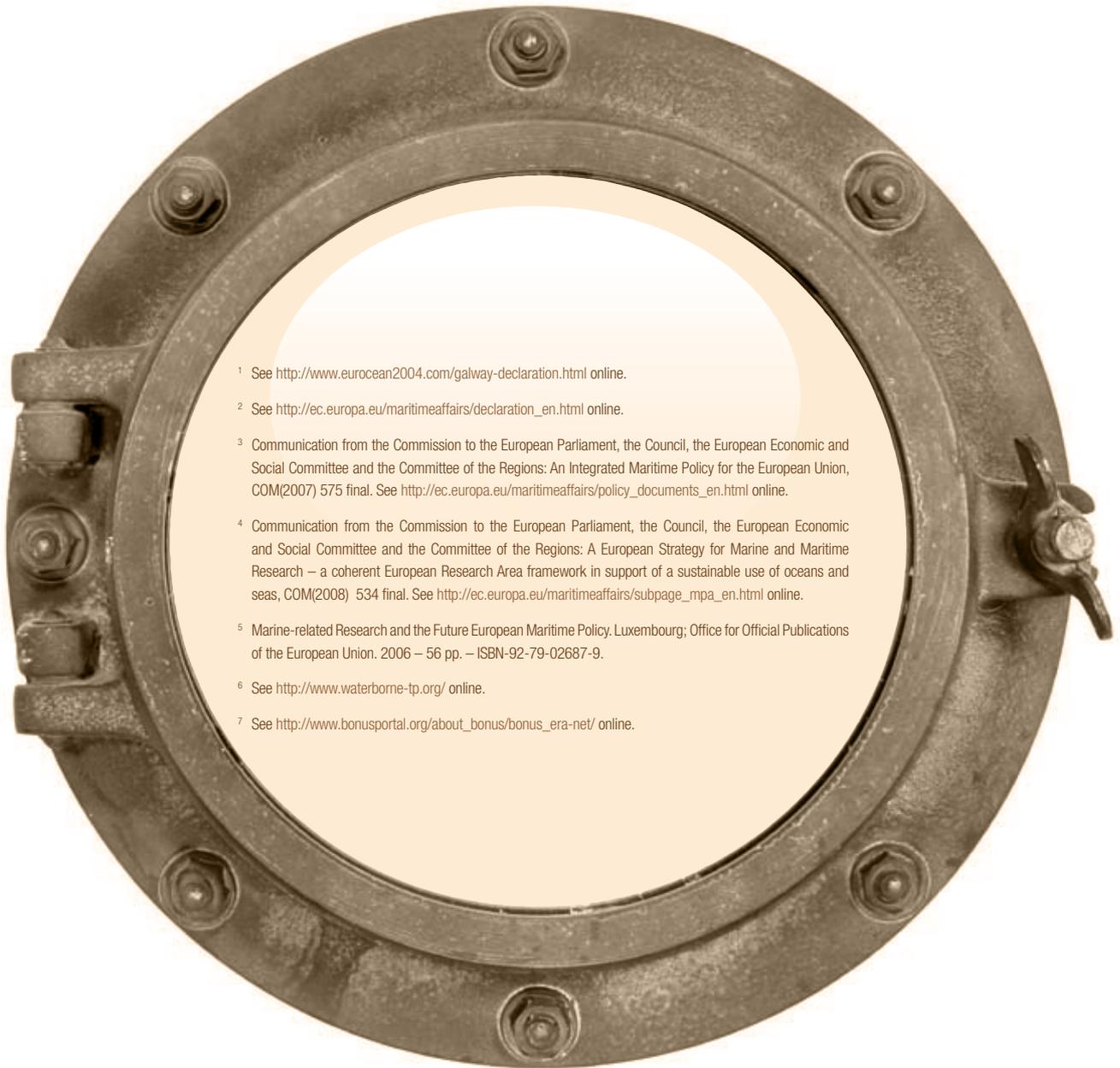
Marine and maritime research coordinated across disciplines, supported by extensive infrastructure, and supported by Member States and partner countries acting together, holds the key to predicting the impact of human activities and climate change on the marine environment while helping ensure that the development of these activities is environmentally sustainable.

With its strategy for marine and maritime research, the EU is resolutely addressing this crucial challenge.



The sheer size and depth of the ocean has led us to the mistaken belief that it can withstand infinite exploitation. By taking measures now, we can repair the damage caused by human activities while continuing to benefit from what the ocean can offer us – food, jobs, the potential for alternative energy sources, such as wind and wave power, rich seams of unexplored mineral resources, and the exciting new science of biotechnology.

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¹ See <http://www.eurocean2004.com/galway-declaration.html> online.

² See http://ec.europa.eu/maritimeaffairs/declaration_en.html online.

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⁴ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Marine and Maritime Research – a coherent European Research Area framework in support of a sustainable use of oceans and seas, COM(2008) 534 final. See http://ec.europa.eu/maritimeaffairs/subpage_mpa_en.html online.

⁵ Marine-related Research and the Future European Maritime Policy. Luxembourg; Office for Official Publications of the European Union. 2006 – 56 pp. – ISBN-92-79-02687-9.

⁶ See <http://www.waterborne-tp.org/> online.

⁷ See http://www.bonusportal.org/about_bonus/bonus_era-net/ online.

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Reconciling maritime economic activities with preservation of marine ecosystems is one of the major challenges of the European Union for the years to come.

The new European strategy for Marine and Maritime Research adopted by the Commission in September 2008 is an essential pillar of the EU Maritime Policy. It will contribute to the preservation of fragile marine environments while sustaining the development of maritime activities such as transport, tourism, shipping and fisheries.

The strategy sets out two strands of action. The first is designed to reinforce the links between marine research, which addresses the complexity of marine environments, and maritime research, which focuses on the development of new techniques and technologies for a better exploitation of marine resources.

The second strand of action concerns governance. A Forum, made up of stakeholders from the marine and maritime research communities, governments, regions, industry and representatives from the civil society, will be established to set common research priorities and define measures to implement the strategy.

The Commission will act as a facilitator, overseeing implementation and providing support through a range of funding mechanisms, in particular the Framework Programme.



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