

UK MARINE SCIENCE STRATEGY

– shaping, supporting, co-ordinating and enabling the delivery of world class marine science for the UK.

A 15 year strategy to support the development, co-ordination and focus of marine science in the UK, across Government, industry, Non-Governmental Organisations and other sectors.

2010 - 2025

UK MARINE SCIENCE STRATEGY 2010 - 2025

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Executive Summary

The need for a UK Marine Science Strategy:

i) The seas and oceans are fundamental to sustaining life on earth. Marine science provides the vital knowledge and information to enable us to take key decisions on the management of our seas and oceans which will affect generations to come. As the increasing impacts of, for example, climate change and other human activities on the marine and wider environment become more evident, and as the growing opportunities the marine environment offers to deliver food and energy security and to generate wealth sustainably are recognised, we look increasingly to marine science to inform both our understanding and our actions. To-date, however, there has been no common UK view of what marine science needs to be put in place, or a co-ordinated approach to ensure it is delivered. This Strategy will address these key issues.

The Strategy's purpose:

- ii) This Strategy sets the direction of travel for future marine science across the UK for the period 2010 to 2025. It does so by:
- identifying **high level priority areas for marine science**; and by
 - **tackling cross-cutting barriers**, to help deliver the science.

Through its approach, the Strategy provides an **agreed, strategic framework for shaping, supporting, co-ordinating and enabling the delivery of world class marine science for the UK**. It will help to produce the portfolio of evidence needed if we are to achieve the UK vision of having '**clean, healthy, safe, productive and biologically diverse oceans and seas**'.

Development of the Strategy:

iii) The Strategy has been developed jointly by the UK Government and the Devolved Administrations through the Marine Science Co-ordination Committee¹ and in liaison with the UK marine science community. The Strategy was a key

¹ The Marine Science Co-ordination Committee (MSCC) is comprised of the Government Departments, Devolved Administrations and main delivery bodies involved in UK marine science, and 3 non-executive members. Further details are at: <http://www.defra.gov.uk/environment/marine/science/mscc.htm>

recommendation of a House of Commons Select Committee Report². It is not intended that it should be a 'strategy of strategies', nor does it seek to duplicate existing strategies. Rather it sets the broad direction for future marine science and identifies where more co-ordinated working and greater alignment can deliver the greatest results.

High-level science priorities:

iv) The Strategy sets out 3 high level priority areas:-

- **'understanding how the marine ecosystem functions'**;
- **'responding to climate change'; and**
- **'sustaining and increasing ecosystem benefits'**.

Within these high level priorities the Strategy describes some of the key policy questions that need to be addressed and the natural and social science research needed to provide the evidence to support critical policy decisions.

Tackling the barriers to delivery:

v) The Strategy also identifies a range of cross-cutting measures that will strengthen co-ordination between the main funders and providers of marine science in the UK and overcome barriers, ensuring that resources are better aligned to deliver world class marine science for current and future policy needs. Three key areas of action have been identified as priorities to be taken forward in the first phase of the Strategy:

- **Alignment of science effort** – ensuring marine science programmes, their funding and capabilities are focused effectively in areas of high impact. Topics, within the three high level priorities, will be selected via a rolling programme, to check that resources and capabilities across research funders and providers are most effectively aligned;

² <http://www.publications.parliament.uk/pa/cm200607/cmselect/cmsctech/470/470i.pdf>

- **Long-term monitoring** – making the process for selecting long-term observation systems for funding more transparent and providing secure, longer-term and cross-cutting funding for these datasets; and
- **Communications** – developing a pro-active communications strategy for strengthened two-way engagement with the public on the importance of marine science and delivering an action plan for improving communication between scientists and policy makers.

vi) The Marine Science Co-ordination Committee will also continue to **work with and through others**, to support, co-ordinate and enable barriers to delivery to be overcome, as part of its continuing business. This will include: steps to improve access to data; the identification of future skills needs for marine science; and promoting measures to help marine industries grow, including through skills and training. Further actions will be developed during the life of the Strategy and ‘**horizon scanning**’ will be a key process to help inform decisions on its future direction. The Strategy will apply to all types of marine science - from basic, blue skies research to applied research, as well as spanning the natural and social sciences. Its focus will be on publicly-funded marine science.

Delivery of the Strategy:

vii) The Marine Science Co-ordination Committee will drive forward the delivery of the Strategy. In doing so, it will work closely with the wider UK marine science community, with partner bodies in Europe and other countries to produce the most effective evidence base. The Marine Science Co-ordination Committee’s work will be overseen by a Ministerial Marine Science Group, to which the Committee will provide an annual published report which will include progress on delivering the Strategy, and details of the level of public sector expenditure on marine science. A web-based Marine Science Strategy Delivery Plan, at: [*weblink*], will track progress against the actions identified within the Strategy.

viii) This Strategy has been developed at a time when marine science is increasingly needed to inform far reaching decisions while resources are ever more constrained. The Strategy, with its strong cross-cutting, collaborative approach, will be a key tool to ensure UK marine science is delivered effectively and efficiently in the coming years and in maintaining a world class marine science base within the UK.

The UK Marine Science Strategy

UK Marine Science Strategy Operating Principles:

The Strategy will

- apply to all science funded by the Departments, Devolved Administrations and bodies represented on the Marine Science Co-ordination Committee.
- address key barriers to the development and delivery of marine science.
- involve stakeholders in the actions being delivered.
- result in a series of regularly updated actions outlined in a publicly available Delivery Plan.
- enable a step change in the co-ordination of UK marine science, and in the ease and effectiveness of its delivery, over the next 15 years.
- help to cultivate an environment in which high quality science is consistently delivered.

The importance of marine science

1. This is an important and exciting time for marine science. There has probably never been a period when our need for knowledge about the seas and oceans has been greater. Fundamental decisions on the management of our seas and oceans must be taken in the next few years; they will affect generations to come.
2. The Marine Science Strategy has an important role to play as it will provide the high level direction to help us develop the marine science that will be needed to answer some of the big policy questions that are being asked, such as:

Food security - how can we secure sufficient healthy, affordable and sustainably sourced fish and marine products for an increasing world population?;

Energy security – how can we capture the ocean’s valuable energy supply in a way that allows us to mitigate climate change whilst not prejudicing the health of the marine environment?

Climate change – how will the seas and oceans and the life within them change as a result of increasing greenhouse gases and to what extent can they mitigate its impacts?;

Economic benefits - how can we optimise the opportunities the oceans provide for generating economic benefits sustainably, whether by sourcing new products, such as bioactive compounds, or by increasing the availability of marine-based renewable energy, or through sustainable fishing and mariculture?;

Human activity – how should we seek to influence behavioural change in existing human activities, to prevent adverse impacts on the marine environment?

3. Marine science will provide the evidence upon which informed choices can be made about how we wish to balance the costs and benefits associated with the use we make of the seas and oceans, and also the way in which they influence our lives. These influences can be large and, when properly managed, can be channelled to enhance the health, wealth and wellbeing of the nation. It is essential that we understand how the seas and oceans are structured and how they function in response to some of the biggest challenges of our time – such as climate change, food security and energy availability – if we are to continue to find ingenious solutions to seemingly intractable problems.
4. The changing policy landscape will also require significant decisions, for example: on bio-diversity, conservation and climate change targets; the determination of ‘good environmental status’, to enable implementation of the EU Marine Strategy Framework Directive; the practical application of marine spatial planning required by the UK Marine and Coastal Act and the Devolved

5. The seas and oceans are essential to sustaining life on Earth. They are a major factor regulating our climate and support 80% of the world's animal and plant species. They provide us with a rich range of economic, social and cultural benefits, such as food, energy, materials, tourism, and heritage assets (e.g. historical shipwrecks). Marine activities alone are worth around £46bn³ annually in the UK. Emerging knowledge and technologies are opening up exciting possibilities, such as the development of new medicines and novel sources of energy. Whilst the oceans most directly affect those who live on or near the sea, their influence also extends far inland - for example through the way they control climate. At the same time changes in the oceans, such as the retreat of polar ice, ocean acidification, and rising sea levels, also present challenges that we need to predict and circumvent. Increases in sea level alone could directly affect the 17 million people who live within 10km of the sea in the UK, as well as important national infrastructure and much of our manufacturing industry⁴.
6. This is a fragile and complex relationship. If we are to manage marine resources sustainably and plan effectively we need to make the right policy decisions, not just for now but for the future. Marine science provides the vital evidence to inform the critical policy decisions – from: conserving fish stocks, managing aquaculture systems and protecting communities from flooding and storm surges; to adapting to and mitigating for climate change, and to increasing the sustainable productivity of marine industries, including the sourcing of renewable energy from the seas.

A strategic framework

³ Direct marine related activities contributed £46bn Gross Value Added (GVA) to the UK in 2005-06. Pugh, D. Socio-economic Indicators of Marine-related Activities in the UK economy. The Crown Estate copyright. March 2008. ISBN: 978-1-906410-01-8

⁴ <http://www.environment-agency.gov.uk/research/library/data/34449.aspx>⁵ Links to related strategies and plans are provided in Annex 1.

7. The UK Marine Science Strategy provides the strategic framework for developing the marine science that will meet these evidence needs. The Strategy has been developed jointly by the UK Government and the Devolved Administrations. It will deliver significant improvements in the way marine science is prioritised, co-ordinated and delivered in the UK, including the better co-ordination of funding. This is of particular importance as we adopt a more ambitious, holistic approach to marine management with demanding requirements for scientific knowledge and understanding.
8. The Strategy is mainly aimed at those working within, and around, the marine science community. However, it will also be of interest to those with a more general concern for marine science issues. The Strategy also recognises the importance of marine science to society generally.

How the UK Marine Science Strategy will make a difference:

The Strategy will –

- Bring about better co-ordination of policy priorities, research programmes and funding;
- Improve value for money by establishing a long-term, simple but robust strategic framework within which priorities can be set out on a rolling basis, as they arise.
- Deliver actions not just words.
- Focus initially on a few high priority cross-cutting issues which, if addressed successfully, will make a significant difference to UK marine science.
- Introduce more effective collaboration and co-operation among member bodies of the Marine Science Co-ordination Committee and the wider marine science community.

9. Expertise in marine science is spread across a wide range of Higher Education Institutes (HEIs) and research institutes, industries, Non-Governmental Bodies (NGOs), Government departments and agencies. It is recognised that individual organisations will have their own science priorities and geographical regions of interest, often articulated in separate strategies⁵. The UK Marine

⁵ Links to related strategies and plans are provided in Annex 1.

Science Strategy is not a 'strategy of strategies' and does not seek to duplicate existing strategies or to dictate what individual funders should do. Rather it provides a framework to establish broad priorities and identify cross-cutting barriers to delivery and actions to address these over the period 2010 to 2025.

How the Strategy is organised

10. The following sections set out:-

- a) the **scope** of the Strategy – what it includes and excludes (paras 11– 14);
- b) the Strategy's **objectives and policy context** – how the marine science will underpin the UK's vision for 'clean, healthy, safe, productive, and biologically diverse oceans and seas' (paras 15 – 19);
- c) the **high-level science priorities** of:
 - 'understanding how the marine ecosystem functions' (para 20 – 22),
 - 'climate change and the marine environment' (23 – 25); and
 - 'sustaining and increasing ecosystem benefits; (para 26 – 32)
- d) **how barriers to delivery will be tackled** – the cross-cutting issues affecting delivery of the science priorities and actions to address them (paras 33 – 49);
- e) the role of **horizon scanning and future actions** as the Strategy continues to develop over its 15 year lifespan (para 50); and
- e) details of **how the Strategy will be delivered** (paras 51 - 55).

Additional information on related plans, strategies and legislation can be found in the Annexes.

Scope of the Strategy

11. The Strategy has been developed by the Marine Science Co-ordination Committee⁶, with significant input from the UK marine science community. It draws heavily on the findings of the House of Commons Science and Technology Committee's comprehensive Report, "Investigating the Oceans"⁷. The Strategy has an initial target life of 15 years and will be reviewed at five yearly intervals.
12. For the purposes of this Strategy, 'marine science' is taken to include social sciences, for example, social and economic analyses, as well as natural sciences and the technology needed to support marine science, such as instrumentation. At the same time, the Strategy spans the full range of science activities, from curiosity-led 'blue skies' research to directed strategic programmes. Effective integration across natural, social, economic and technological science will be key to the delivery of the marine science required by policy makers. Such an integrated approach would be needed, for example, in order to understand how sustained behavioural changes can be achieved that help to reduce the negative impacts of human activity on the marine environment.
13. The Strategy is intended to be primarily a 'marine', rather than a 'maritime', science strategy and its focus is on the marine environment and on understanding how marine systems work - how they impact on us and how we impact on them. Science for maritime structures (such as ships, oil & gas platforms, ports & harbours, and renewable energy structures) will be included in so far as it relates to their impact on the marine environment (e.g. research on dealing with different types of oil pollution resulting from shipping incidents and on the impact of noise on marine organisms).
14. The geographic spread of the waters covered by the Strategy is not limited. The principle of improving co-ordination and delivery of marine science also applies to UK scientific activities, for example, in far oceans (including the

⁶ The Marine Science Co-ordination Committee (MSCC) is comprised of the Government Departments, Devolved Administrations and main delivery bodies involved in UK marine science, and 3 non-executive members. Further details are at: <http://www.defra.gov.uk/environment/marine/science/mscc.htm> and in Annex 1 of this Strategy.

⁷ "Investigating the Oceans" 18 October 2007 HC 470-1 + link

waters of UK Overseas Territories). In areas of potential science and policy overlap, such as the land/sea and atmosphere/ocean interfaces, where the dividing lines are not always clear, a pragmatic approach will be taken in applying the Strategy.

STRATEGY OBJECTIVES

Policy context

15. The UK Marine Science Strategy supports and complements UK marine policy and, in particular, the overarching vision of **‘clean, healthy, safe, productive, and biologically diverse oceans and seas’**. This policy vision is described in more detail in the High Level Marine Objectives⁸. These also describe what achievement of the vision would mean for the seas and oceans in 20 years’ time and the outcomes needed to make this possible.

The High Level Marine Objectives are set in the context of the five sustainable development principles:

- Achieving a sustainable marine economy
- Ensuring a strong, healthy and just society
- Living within environmental limits
- Promoting good governance
- Using sound science responsibly

They reflect the full range of UK Government and Devolved Administrations’ policies in the marine area. The objectives will be used in the development of a UK Marine Policy Statement, which will provide a framework for achieving sustainable development. They have already been taken into account in developing the UK Marine and Coastal Access Act and the Devolved Administrations’ Marine Bills. They also define the UK approach to international policy measures, such as the EU Marine Strategy Framework Directive, EU Water Framework Directive, OSPAR convention and other agreements.

⁸ <http://www.defra.gov.uk/environment/marine/documents/ourseas-2009update.pdf>

16. In order to achieve the vision of having ‘clean, healthy, safe, productive and biologically diverse oceans and seas’, major policy decisions, with implications for generations to come, will need to be taken over the next few years. These include measures to help society mitigate and adapt to climate change; develop new, clean, secure energy sources and sustainable, secure food supplies; and reduce the loss of biodiversity⁹.
17. The vision requires an holistic approach to policy making. It seeks to integrate and manage the range of demands placed on the environment in such a way that it can be conserved and can indefinitely support essential services and provide benefits for all – an ‘**ecosystems approach**’¹⁰.
18. The development of an integrated and sustainable policy approach requires an understanding of the associated coupled social and ecological systems. Social and economic drivers produce pressures on natural systems that, together with climate change, alter ecosystems and affect human welfare. Some of these changes are inevitable and require adaptation whereas others can be foreseen and avoided or their effects minimised.
19. We are not only interested in the drivers, the impacts and benefits, and how natural systems behave, we also need to understand the way they relate to one another, how they respond to change, and the options that are available to policymakers, through policy and planning, for maintaining a healthy ecosystem where benefits are maximised and adverse impacts minimised. The linkage between these elements is illustrated in Figure 1.

⁹ http://www.hm-treasury.gov.uk/pbr_csr07_psaenvironment.htm

¹⁰ The ecosystem approach can be defined as ‘A resource planning and management approach that recognises the connections between land, air, water and all living things, including people, their activities and institutions’ (www.mnr.gov.on.ca/en/Business/FW/2ColumnSubPage/STEL02_168425.html#E)

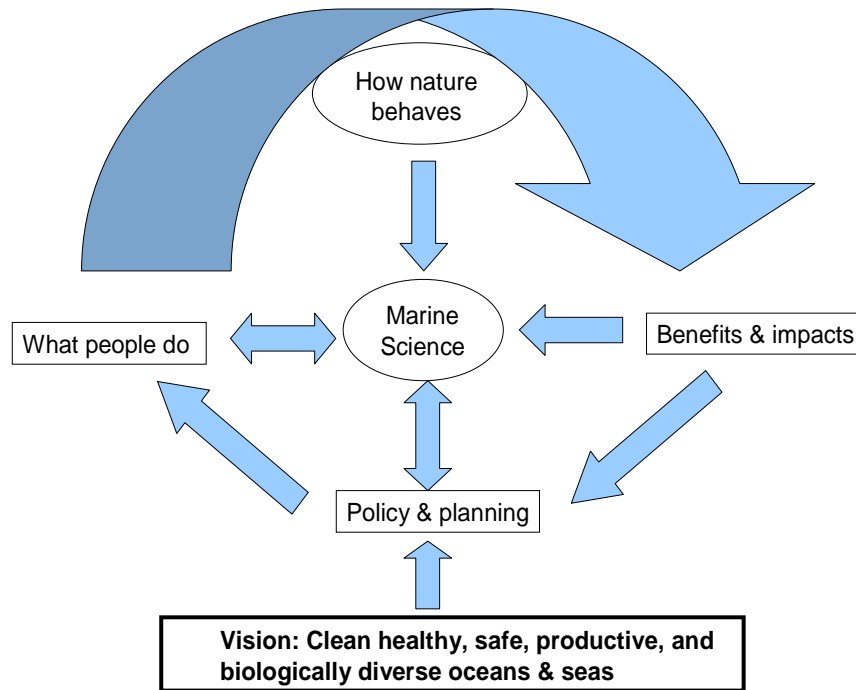


Figure 1

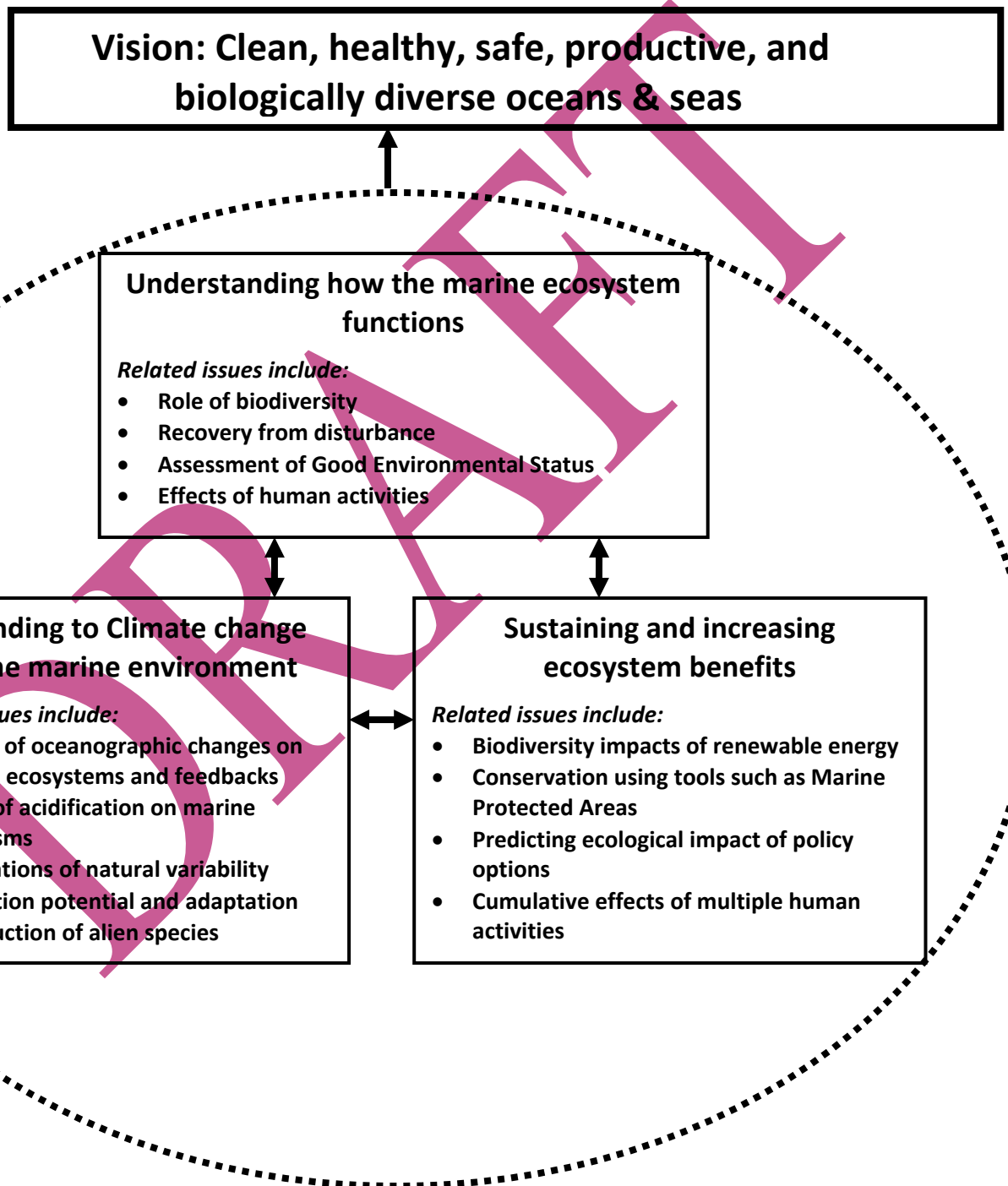
High-level science priorities

20. Three headline marine science priority areas have been identified as essential to underpin the ecosystems approach outlined in paragraph 16: - **‘understanding how the marine ecosystem functions’, ‘responding to climate change’ and ‘sustaining and increasing ecosystem benefits’**. These are consistent with the themes which have emerged from discussions with stakeholders and the views of the bodies represented on Marine Science Co-ordination Committee. They also align with other initiatives such as Living With Environmental Change¹¹, a major collaborative programme agreed by 20 departments, Devolved Administrations and agencies. They are therefore already part of a broader cross-governmental strategy. The following sections explain the importance of each of the three priority areas and their policy

¹¹ <http://www.lwec.org.uk/>

relevance. It is notable that human activity affects all three areas. The relationship between the science priorities and the policy vision is illustrated in Figure 2.

Figure 2



‘Understanding how the marine ecosystem functions’

Related policy question¹² include:

- *What is the role of biodiversity in maintaining specific ecosystem functions?*
- *How long does the seabed take to recover from disturbance such as dredging, wind-farm construction and oil and gas extraction?*
- *How do we establish a basis for reliable Good Environmental Status indicators?*

21. In order to underpin policy-related marine science there is a continuing need to improve our understanding of how the marine ecosystem works. It will be important to capture the implications of the new knowledge gained from all modes of research, including within the academic sector, for future policy development and implementation.

22. Among the topics that need addressing are: the **role of biodiversity in maintaining specific ecosystem functions** (e.g. biogeochemical cycles), and **how long it takes for the ecosystem to recover from disturbance** such as the impact of dredging and off-shore wind-farm construction, and **identifying the nature of sustainable use**. A further issue, in relation to the concept of **Good Environmental Status (GES)**, is how we can use the best available science to develop robust indicators (as required by the European Marine Strategy Framework Directive). The concept of GES involves human value judgements and therefore **both natural and social science is needed** to determine management options. Human activity and footprint is moving progressively into deeper waters and there is a need to close the knowledge gap concerning especially vulnerable **deep sea ecosystems**.

¹² based in part on Sutherland et al (2006) ‘The identification 100 ecological questions of high policy relevance in the UK’, *Journal of Applied Ecology*, 43: 617-627

23. The improved understanding of ecosystem functions will contribute to the more applied priority areas of responding to climate change and sustaining and increasing ecosystem benefits. Both are described below.

‘Responding to climate change’

Related policy questions¹² include:

- *How will changes to oceanographic conditions as a result of climate change affect marine ecosystems?*
- *How will acidification of surface water from rising CO₂ concentrations affect planktonic productivity and other marine organisms?*
- *What are the implications of natural variability and how can we distinguish from anthropogenic causes?*
- *What is the potential for mitigation and how do we plan better for adaptation?*

24. The oceans both drive and respond to the weather and climate. They are critical to understanding and predicting the course of future climate change because of their capacity to absorb, store and globally redistribute carbon, heat and freshwater. **Changes in the oceans themselves**, e.g. rising temperature and acidification, as a result of greenhouse gas emissions, have already become evident and have **important consequences for the marine ecosystem**. This is a key policy issue but scientific knowledge is far from complete. There is a particular need to improve understanding at the national/regional scale and on decadal timescales to provide a **more robust evidence base for adaptation planning**. This includes improved estimation of sea-level rise, determining **thresholds for rapid or irreversible change**, and identifying the wider implications of **future changes in the Polar regions**. Suggestions that the oceans could be used to **mitigate climate change**, for example by increasing their ability to absorb and store carbon, including seabed storage of carbon dioxide, have raised concerns about possible adverse impacts. It is recognised that more research is needed in these areas.

25. As well as changing in response to greenhouse gas emissions, the climate system is subject to **natural variability**. The oceans play a significant role in

such variability, examples being the El Nino and, of greater importance to the UK, the **North Atlantic Oscillation, of which the Gulf Stream is a part.** There will be a continuing need to **quantify the ocean's role in the climate system.** At shorter time scales, the influence of the seas on weather is of great societal importance, e.g. monitoring and predicting extreme events and hence **protecting the safety of life** and improving the efficiency of operations at sea.

26. The ability to assess the implications of climate change and variability for the marine environment in a systematic way is crucial if sound management policies are to be put into effect. In particular, there is a growing demand globally and regionally for high quality longer-range climate forecasting, risk analysis and advice, to enable **climate change and variability to be embedded in practical decision making** at all levels for all sectors (e.g. agriculture, water management, urban planning, energy provision, health services). Ocean information will be essential and integral to the development and continual improvement of climate information. In this context, the **Marine Climate Change Impacts Partnership (MCCIP)**¹³, in which many organisations contribute to regular assessments of current and future changes, **is an example of good practice** which the Strategy will seek to support and encourage.

'Sustaining and increasing ecosystem benefits'

Related policy questions¹² include:

- *What are the comparative environmental effects of newly emerging types of renewable energy, such as wave energy?*
- *How should the choice be made between marine protected areas and other conservation measures,; when MPAs are appropriate, how large and where should they be located to protect biodiversity and enhance surrounding fisheries?*
- *With what precision can we predict the ecological impact of different policy options and the ecological effects of management action?*
- *How do we assess cumulative effects of multiple human activities and the effects on the ecosystem, and how can this translate into taking management action?*

¹³ <http://www.mccip.org.uk/>

27. Ecosystems are dynamic and complex functional units of plant, animal and micro-organism communities as well as the non-living environment. It is

important to acknowledge that people are also part of ecosystems - benefiting from the services ecosystems provide and support but also capable of having significant and perhaps long-lasting effects on them. This is just as true of the marine ecosystem, although the benefits and impacts may seem less obvious than on land. Decision making within the context of an ecosystem approach (e.g. regulated exploitation of resources) can involve both losing some benefits and gaining others. It is therefore important to **understand the trade-offs involved with different management options in marine spatial planning** and to engage with affected communities as part of the decision-making process. This will require a mix of social, economic and natural science expertise.

28. The vision (in paragraph 14) expresses the balanced approach to the use and management of our seas. The need to make use of the sea's resources has to be weighed against potential disruption and damage to the marine environment and to the life within it. Social science will play an important role in establishing frameworks for choice - to help reach informed decisions on possible courses of action. In order to address the policy issues around sustaining and increasing ecosystem benefits, a broad range of science will be needed, of which the following is illustrative.

29. The potential of the marine environment to **increase food and energy security** is clear but more work is needed on defining its full potential, including the limits on sustainable production and the changes in human behaviour needed to achieve a correct balance. In particular, attention needs to be given to the **comparative biodiversity impacts of different renewable energy technologies**, such as those exploiting waves and tides.

30. Within the framework of marine spatial planning, **there is a range of tools for conservation, including Marine Protected Areas (MPAs), and evidence is needed to establish which tools are appropriate in particular situations.** For example, we need to understand how the location, geographical extent and connectivity of key habitats and species may impact on their conservation needs and therefore on the choice of tools best suited to protect and enhance them. Marine science will have an important role to play in informing such decisions - for example, through **seabed and habitat mapping** - and in assessing the efficacy of such policies by monitoring and interpreting observed outcomes.
31. Often the potential impact of an activity is considered in isolation from others. There is a need to develop scientifically-based methods for **assessing the cumulative effects of multiple human activities on the ecosystem** and then translate this into management action. An example is **underwater sound** emitted from a variety of sources (e.g. ships, sonar, pile driving), each element of which may be within an acceptable limit but when added together may be harmful to marine mammals. Another is the combination of **high nutrient inputs** arising from river run-off, discharges to the sea and point-source **pollution** from off-shore activities.
32. One of the policy needs that has been identified is to know how well the **ecological impact of different policy options** can be predicted, including the effects of any management actions taken on the ecosystem. Computer models of the ecosystem, incorporating relevant *in situ* and remotely-sensed data, have potential. However more work is needed, particularly on improved understanding and representation of the biogeochemical processes involved, before they will be a reliable tool. **Ecosystem models, used for operational forecasting**, will also contribute to **safer use of our seas**, and, via warnings of algal blooms, etc., to **human health**.

TACKLING THE BARRIERS TO DELIVERY

33. Addressing these high level priorities is a major challenge. It will require **world class science** exemplified in the UK by a science community which is able to work collaboratively across disciplines, in large teams and with international partners, and whose work is internationally recognised. Maintaining the strength, capacity and focus of our marine science will be the key to success. However, barriers exist to achieving this. Identified below are a range of cross-cutting measures that will help to overcome these barriers and to ensure resources are better aligned to deliver world class marine science for current and future policy needs.

34. Three areas have been identified as priorities to be taken forward in the first phase of the Strategy:-

- **Alignment of science effort** – ensuring science programmes, funding and capabilities are focused effectively in areas of high impact;
- **Long term monitoring** – making the process for selecting long-term observation systems for funding more transparent and providing secure, longer-term and cross-cutting funding for these datasets; and
- **Communications** – developing a pro-active communications strategy for strengthened two-way engagement with the public on the importance of marine science and delivering an action plan for improving communication between scientists and policy makers.

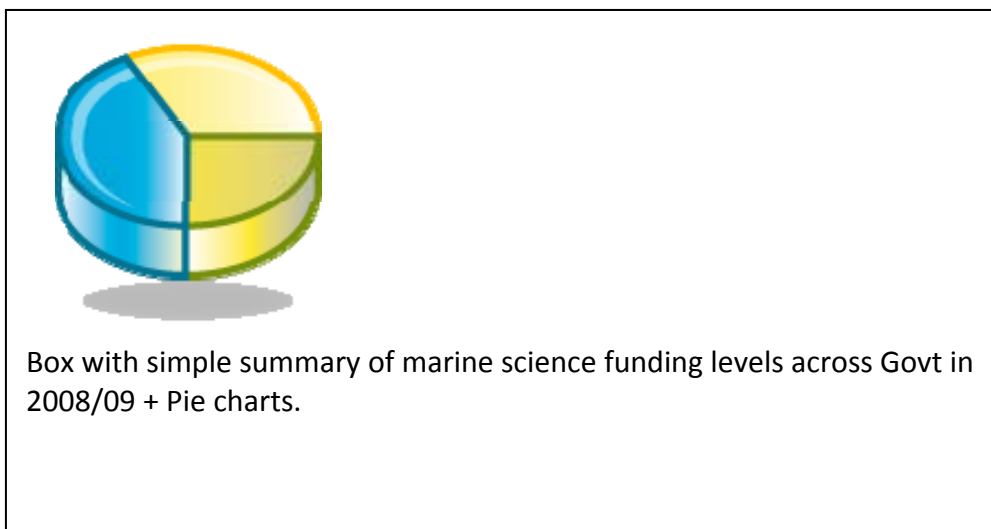
Additionally, as part of its continuing business, the Marine Science Co-ordination Committee will also support initiatives being taken forward by other bodies by

- **Working with others.**

These are described in more detail in the following sections.

Alignment of science effort

35. The difficult and extensive nature of the marine environment means that research tends to be very expensive while resources and expertise are limited. Increased collaboration and co-ordination of funding can deliver more cost effective, better prioritised research and help to avoid important areas of work being left unfunded.



36. We therefore need to be clear that current and planned publicly-funded science programmes addressing the high-level priority areas (identified in paragraphs 19 – 31) are properly aligned and coherent. We must also ensure that the research being planned is relevant to future, as well as current, policy needs.

37. The Marine Science Co-ordination Committee will, through a rolling review programme run over the life of the Strategy, identify groups of science issues within the three high level science priorities where greater collaboration and alignment can have largest impact. The initial group of science issues will be identified during the first quarter of 2010. The programmes funded by member bodies of the Marine Science Co-ordination Committee to address these science issues will be reviewed

to identify gaps in scientific knowledge and policy development, areas of duplication and areas for further collaboration and alignment.

38. The outcomes of the review will also feed into the **co-ordination of UK policy input to research programmes under the EU Framework Programme and other international programmes, to provide better alignment with UK priorities.**

39. As part of the review programme, **the capacity and capability to deliver the science will be assessed.** This will help to ensure that the necessary equipment (including research vessels), infrastructure and expertise are available and will help to identify whether they are being used efficiently across the bodies represented on the Marine Science Co-ordination Committee.

40. **It is also recognised that significant programmes of marine science are being undertaken by other parts of the marine science community¹⁴, e.g. Higher Education Institutions (HEIs), Non-Governmental Organisations and industry; stakeholders will be invited to contribute to this review process.**

Long-term monitoring

41. Sustained observations¹⁵ are essential for much of marine science because changes in the marine environment generally only become apparent over extensive time scales of decades or longer. The delivery of long-term monitoring programmes was **the key issue** identified by stakeholders during the preparation of this Strategy. More specifically the particular barriers highlighted were:

¹⁴ Pugh, D. Socio-economic Indicators of Marine-related Activities in the UK economy. The Crown Estate copyright. March 2008. ISBN: 978-1-906410-01-8.

¹⁵ By sustained observations we are including the whole spectrum of observations from research to compliance monitoring. To be cost-effective this requires funding from different Government sources.

- i. the current lack of transparency in how decisions are made by funders to support one observation system over another;
- ii. the difficulty of finding sufficient funding sources for projects which provide information for many users but where there is no clear 'owner' body; and
- iii. the mismatch between short-term Departmental budget policies and the long term nature of the projects.

42. The Marine Science Co-ordination Committee is working with the UK Environmental Observation Framework (UK-EOF)¹⁶ and the UK Marine Monitoring and Assessment Strategy (UKMMAS)¹⁷ to address these issues¹⁸. The UK-EOF, with input from the marine science community, is developing an inventory that catalogues current data sets and identifies foreseeable requirements for long term data. It is assessing the UK's capacity to deliver these data (taking account of international activity) and, where available, alternative ways to collect the data.

43. The results of this exercise will be used, with input from stakeholders, to develop a transparent prioritisation tool to help inform decisions on the funding of observation systems (for both starting and stopping observation systems), including the contribution of remote sensing data from satellites. This will extend beyond those required to meet mandatory requirements. These outputs will be used as part of the process for delivering the UK Marine Monitoring and Assessment Strategy and to inform co-ordinated decisions on funding by the Marine Science Co-ordination Committee.

44. In addition to collaborating on the development of the prioritisation tool, the Marine Science Co-ordination Committee will also develop practical proposals to provide cross-cutting, longer-term funding for priority long term monitoring systems.

¹⁶ <http://www.erff.org.uk/activities/uk-eof.aspx>

¹⁷ Link to Annex with short description of UKMMAS, MARGE & MAPC, plus an explanation of the relationship between MAPC/UKMMAS & MMSCC – a frequently asked question.

¹⁸ The Marine Science Co-ordination Committee has established a Working Group, comprised of academics, researchers, the heads of UKMMAS groups and Government representatives, to work with E-OF.

45. **The Marine Assessment Policy Committee, which has overall responsibility for UKMMAS, will merge with the Marine Science Co-ordination Committee¹⁹. The merger will reduce potential overlap and improve overall efficiency. Further opportunities to rationalise the co-ordination bodies in the marine science sector to reduce duplication of effort will be actively sought.**

Communications

46. As demonstrated in the opening sections of the Strategy, the marine environment is critical to the lives of everyone. **A key action will be to engage the wider public in discussions on marine science issues. This two-way exchange will involve both raising public awareness of the impact of the seas and oceans on our lives and the impact of our actions on them. It will focus on marine sustainability issues, and will listen and respond to the issues and concerns raised.** The Marine Science Co-ordination Committee will develop a communications strategy, by mid-2010, setting out key messages and providing a framework for the Marine Science Co-ordination Committee and its member organisations to engage with citizens across all social groups, through co-ordinated activities, including actively publicising marine science developments in non-technical language to a wider, non-scientific audience. It will link with existing activities, such as the public engagement strand of the Science and Society initiative²⁰.

47. It is also important that **the extent and clarity of communications between scientists and policy makers continue to be improved.** Gaps in the two-way flow of policy and science information have the potential to lead to key emerging scientific findings not being reflected in Government policy in a timely manner and funding opportunities being missed. The Marine Science Co-ordination Committee will develop an action plan, by mid 2010, to promote best practice for communicating science into policy, and policy development and priorities to scientists. **This approach will build on successful existing**

¹⁹ **DN** To be updated for published version. This merger is subject to the endorsement of the Marine Assessment Policy Committee (MAPC).

²⁰ http://www.dius.gov.uk/science/science_and_society/public_engagement

initiatives²¹ and will include the development of internships jointly within Government Departments and the Devolved Administrations, to enable research scientists to gain direct experience of policy development and delivery.

48. Those responsible for representing the UK across the wide range of intergovernmental marine science fora also need to have access to shared information on the emerging science. **A network of UK marine science representatives will be established by the Marine Science Co-ordination Committee to identify common marine science issues and to exchange views on the latest science thinking.**

Working with others

49. The Marine Science Co-ordination Committee will look for opportunities to work with other bodies, to help take forward their initiatives, for example:-

a. **Effective access to data** – The Marine Environmental Data & Information Network (MEDIN)²² - a partnership of UK public and private organisations - has commissioned a study, building on existing analyses, to identify the impacts and issues associated with charging and intellectual property rights specifically for marine data products. This will complement MEDIN's existing programme of work to improve access to data by collating organisations' data and information, providing direct links to data from commercial organisations and European and international bodies and its current development of a 'data discovery portal', a powerful tool for searching out marine data across organisations.

b. **Future skills needs** - The Environment Research Funders Forum (ERFF) is reviewing skills requirements for the UK environmental

²¹ NERC booklet on science into policy: <http://www.nerc.ac.uk/publications/corporate/policy.asp>

²² <http://www.oceannet.org/>

sciences sector²³. This exercise will provide an assessment of the available training and education opportunities and likely future trends, and develop actions to address any current skills gaps.

- c. **Development of a Marine Industrial Strategy** - the Department of Business, Innovation and Skills (BIS) is developing a 'Marine Industrial Strategy' to promote measures for industry to grow through the development of new markets and improved productivity and competitiveness, with a strong emphasis on knowledge (skills and training), as well as innovation and technology.

HORIZON SCANNING AND FUTURE ACTIONS

50. The actions identified above are not intended to be an exhaustive list but to provide a programme of work for the immediate future. Further actions will be developed during the life of the Strategy and 'horizon scanning' will be a key process to help inform decisions on the future direction of the Strategy. This will ensure that science priorities continue to remain relevant to emerging policy priorities. The Marine Science Co-ordination Committee will also take into account the outcomes from the Foresight Global Food and Farming Futures project²⁴. Options for commissioning horizon scanning projects will be considered by the Marine Science Co-ordination Committee during 2010.

DELIVERING THE STRATEGY

Role of the MSCC

51. A key role of the Marine Science Co-ordination Committee (MSCC) will be to drive the delivery of the Strategy and especially the priority actions identified:

²³ <http://www.erff.org.uk/activities/skills.aspx>

²⁴ <http://www.foresight.gov.uk/OurWork/ActiveProjects/FoodandFarmingFutures/FoodandfarmingProjectHome.asp>

the alignment of science effort; long-term monitoring; communications; and working with others. The necessary critical mix of senior policy makers and scientists will be involved in the Committee to ensure that commitments in the Strategy are delivered and that marine science is more effectively coordinated. At the same time, the non-executive members of the Committee will provide an active, external challenge function. The Marine Science Co-ordination Committee will be overseen by a Ministerial Marine Science Group²⁵.

52. While the actions within the Strategy are primarily for Government to deliver, it is recognised that the wider marine science community will also have a role to play if the Strategy is to be successfully delivered. Specific Committee members have been nominated to act as ‘links’ to industry, Higher Education Institutions (HEIs) and Non-Governmental Organisations (NGOs) to develop networks with these communities and to grow an integrated relationship with them. In addition, experts from this wider marine science community will be invited to join working groups and to provide input to projects established to take forward Strategy actions. Through these various actions and mechanisms, stakeholders will be able to access the Committee directly and contribute to the delivery of the Strategy.

Delivery Plan

53. To accompany this Strategy, a web-based Marine Science Strategy Delivery Plan has been created at [www.XXXXXXXXXX]. This sets out the actions being taken to implement the Strategy. It will be regularly updated to show progress against the three priority actions and the other commitments, and to record activities added during the life of the Strategy. A measure of the success of the Strategy will be the effective completion of the proposed actions and the outcomes of the decisions taken

²⁵ The Ministerial Marine Science Group is composed of the marine Ministers of those departments represented on the Marine Science Co-ordination Committee (MSCC).

by the Marine Science Co-ordination Committee. More detailed success indicators will be developed during 2010.

54. Starting with a report on its activities during 2010, the Marine Science Co-ordination Committee will report annually to the Ministerial Marine Science Group. The published reports will include progress on delivering the Strategy and the latest available details of public sector expenditure on marine science.

Conclusion

55. The challenges are significant. We need to deliver the right marine science at the right time in order to meet both current and future policy needs. This requires a clear focus on what science is needed, tighter alignment of programmes and funding and greater coherence of effort across funders and deliverers. We must at the same time find the correct balance between the marine science that helps us to understand better the world we live in now – of climate change, marine ecosystems and their impacts and benefits – and the science that anticipates the issues of the next 50, 80, 100 years. Our ultimate aim is to ensure that the oceans and seas of the future are **'clean, healthy, safe productive, and biologically diverse'**; this Strategy will help the UK to realise this ambition.