Chapter 6: Integrated Assessment
- the Status of the Seas

Rationale and approach for the Integrated Assessment

6.1 The traditional approach to protecting the marine environment has been to focus on the impacts of individual activities. But it is essential to understand how all the various natural and anthropogenic pressures on the seas act together in order to be able to assess how clean, safe, healthy, productive and biologically diverse the marine ecosystem really is. The main purpose of preparing the Charting Progress report has therefore been to get beyond the traditional piecemeal approach and make a first integrated assessment of the environmental status of the UK seas.

6.2 This chapter offers such an assessment. The Government has applied its expert judgement to the totality of the available evidence to gauge the status of water quality, and selected marine biota, seabirds, and habitats and to assess progress towards achieving the vision set out in Safeguarding our Seas. Table 6.1 brings together the key findings including a ‘traffic light’ indication of whether the current status is acceptable, unacceptable or there is room for improvement.

6.3 Judgements of this kind are inevitably subjective. Some of the evidence is capable of differing interpretations. The judgements expressed here represent our best estimate based on the evidence summarised in the preceding chapters and set out in detail in the reports included on the attached CD. They have been reached in consultation with the experts from the bodies listed in Annex 1.

6.4 Table 6.1 includes an indication of our level of confidence in the assessments. It has been clear from the outset that the evidence available for this report is incomplete. There are other data sets, particularly from research findings, which it has not been possible to include in the process of preparing this report, but we believe these would not change the overall conclusions. More importantly, however, there are some aspects of the state of the seas on which the evidence on which to base a judgement is either very limited or non-existent.
<table>
<thead>
<tr>
<th>Key factors and pressures</th>
<th>What the evidence shows</th>
<th>Trend</th>
<th>Status (now)</th>
<th>Confidence in Assessment</th>
<th>Reason for overall status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Quality</strong></td>
<td>Riverine inputs and direct discharges of specified metals, lindane and PAH from point and diffuse sources</td>
<td>Reduction in inputs of metals and other contaminants since 1990 moving towards the OSPAR 2020 cessation target for OSPAR priority substances.</td>
<td>✓</td>
<td>III</td>
<td>On the basis of monitored substances water quality status is improving due to inputs falling. The open seas are generally not affected by pollution. The main contamination problems which are identified are in part due to the legacy of the past and are generally observed at higher levels in industrialised estuaries or areas local to the activity. However, some persistent chemicals are not routinely monitored and mixtures of chemical substances and diffuse inputs may pose a problem.</td>
</tr>
<tr>
<td>Radionuclides</td>
<td>New anthropogenic emissions to marine environment highly controlled and meet internationally accepted exposure levels.</td>
<td>✓</td>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inputs from point and diffuse sources</td>
<td>Some persistent chemicals are not routinely monitored and mixtures of chemical substances and diffuse inputs may pose a problem.</td>
<td>?</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil from accidental spills</td>
<td>No major spills in recent times.</td>
<td>✓</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil from refineries and offshore oil and gas</td>
<td>Controls on deliberate inputs show that oil pollution only affects localised areas.</td>
<td>←</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage discharges and microbiological</td>
<td>Improvements in sewage treatment infrastructure have given greater compliance with EU standards for bathing waters and shellfish waters, but some shellfish quality still fail the standards due to diffuse pollution.</td>
<td>✓</td>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharges and emissions of nutrients from human activities</td>
<td>Direct inputs of nutrients from point sources discharging directly to the sea and atmospheric emissions of nitrogen have reduced by 35% since 1990. (NB direct inputs only account for roughly 25% of all nutrients inputs). Overall inputs of diffuse sources to the sea are unquantified.</td>
<td>✓</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coastal habitats</strong></td>
<td>Coastal development, erosion, sea level rise and climate change</td>
<td>A number of areas around our coast are vulnerable to erosion. This may be increased by rising sea levels and development on the coast. A number of key coastal habitats are under threat.</td>
<td>×</td>
<td>III</td>
<td>Increasing development and sea level rise around our coastline leads to a narrowing of the coastal zone where natural processes may occur.</td>
</tr>
<tr>
<td>Beach litter and human debris</td>
<td>Litter on beaches is totally preventable and yet quantities of debris are not falling.</td>
<td>←</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benthic communities and associated sea floor habitat</strong></td>
<td>Human activities causing physical disturbance</td>
<td>Benthic communities are adversely affected by human activities which have a physical impact on the sea floor such as fishing and dredging. Bottom trawling activity is the greatest impact since it results in direct mortality, can be over large areas of the sea bed and repeated frequently.</td>
<td>?</td>
<td>I</td>
<td>We have a very diverse range of benthic habitats and species but there are many threats which cause localised damage.</td>
</tr>
<tr>
<td>Chemical contamination</td>
<td>Overall there is no evidence of broad scale impacts of nutrients or hazardous substances on benthic communities. However, some species do show signs of contamination in local areas, often close to the source of the pollution. Endocrine disruption (hormone change) has been detected in dogwels.</td>
<td>?</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td>Commercial fishing</td>
<td>Many species of commercial fish adversely affected by exploitation with many stocks outside safe biological limits in particular regions.</td>
<td>←</td>
<td>III</td>
<td>Our seas are some of the most productive in the world but many fish stocks are threatened by over exploitation.</td>
</tr>
<tr>
<td>Industrial activities and contamination</td>
<td>Although the levels of disease in fish are higher than naturally expected in some UK waters it is unclear if human activities such as pollution are causing this.</td>
<td>←</td>
<td>II</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The confidence is in the quality and amount of data used to underpin the statements made.
Table 6.1: Summary Assessment for UK Seas

<table>
<thead>
<tr>
<th>Key factors and pressures</th>
<th>What the evidence shows</th>
<th>Trend</th>
<th>Status (now)</th>
<th>Confidence in Assessment *</th>
<th>Reason for overall status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>Aquaculture and ecosystem variability</td>
<td>?</td>
<td>I</td>
<td></td>
<td>Our seas are some of the most productive in the world but some fish stocks are threatened by over exploitation.</td>
</tr>
<tr>
<td></td>
<td>Limited evidence that sea lice leaked to the environment from salmon farms may be contributing to the decline of wild stocks of salmon and trout in West Scotland, but other factors also cause mortality.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plankton</td>
<td>Climate change</td>
<td>X</td>
<td>II</td>
<td></td>
<td>Primary productivity in UK waters is naturally high and generally not affected by land based nutrient inputs. Plankton community interdependence with climatic change and its key role in the marine ecosystems function means the entire ecosystem may be affected by a sharp change in the plankton community.</td>
</tr>
<tr>
<td></td>
<td>There has been a significant change in plankton communities populations across the UK sea. This has been shown to be linked to changes in the overall climate.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Nutrients Inputs</td>
<td>The offshore areas are naturally nutrient rich and do not appear to be affected by land based nutrients. Inputs of nutrients from the land are falling and affect only a small number of localised near shore waters and the Irish Sea.</td>
<td>✓</td>
<td>III</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine mammals</td>
<td>Commercial fishing</td>
<td>?</td>
<td>I</td>
<td></td>
<td>We have a large range marine mammals in our waters and have protected breeding and haul out sites for their use. Populations of marine mammals are poorly understood but accidental by-catch from fisheries threatens population stability.</td>
</tr>
<tr>
<td></td>
<td>By-catch of dolphins and harbour porpoises are a significant pressure from some types of fishing methods. Since most cetacean population levels are unknown the overall effects on the sustainability of the system is unclear.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (apart from commercial fishing) anthropogenic activities and climate change</td>
<td>Some seal populations are increasing otherwise mainly stable populations which have recovered from virus epidemics. Areas for seal breeding and haul out designated as SACS.</td>
<td>✓</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seabirds</td>
<td>Climate change and food sources</td>
<td>?</td>
<td>II</td>
<td></td>
<td>The UK holds a significant number of the worlds breeding seabirds and whilst protection of their breeding sites has been achieved there are many other factors such as commercial fishing practises and climate change which probably affect population numbers.</td>
</tr>
<tr>
<td></td>
<td>Although sea bird populations numbers show an overall increase from 1970 to 2000 there is great variability of population health by both species and location. Much of the increase in numbers is due to a few species doing well. There is real concern at the continued rate of decline of other species, particularly those in the North Sea. There was a large decline in population numbers from 1985 to 1990 and since then breeding success has been variable due to a variety of factors. The availability of their food source, sand eels is a major reason which in turn is impacted by both climate change and commercial fishing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial fishing, pollution and oil spills</td>
<td>By-catch as a result of commercial fishing, pollution and oil spills continue to affect seabirds. Fisheries conservation practises which result in less discards and offal thrown overboard may reduce the food source for some species.</td>
<td>✓</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine Species (Biodiversity)</td>
<td>Introduction of species from shipping and climate change</td>
<td>?</td>
<td>I</td>
<td></td>
<td>Overall our seas contain a rich mixture of animals and plants but too little is known to give an idea of the overall status. Climate change impacts represent one of the biggest unknown threats.</td>
</tr>
<tr>
<td>General climate change</td>
<td>Clear evidence that the distribution and abundance of plankton, fish and benthos have been altered by change in the climate regime. Some benefits may be derived from this but the significance of the impact on the overall ecosystem is not yet clear.</td>
<td>?</td>
<td>II</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Assessment

- Unacceptable
- Room for improvement
- Acceptable

Confidence assessment

- High
- Good/Satisfactory
- Low
- No assessment possible

Trends

- Measurement shows improvement
- Deterioration
- No change or variable trend shown
- No trend available or implications not understood
Overview of the significant impacts and pressures affecting status

Influence of Physical processes and climate

6.5 Water depth, ocean currents and weather and climate are the dominant factors that control the marine environment. Weather and climate are highly variable over both space and time, but trends in the longer term datasets show that sea temperature and sea levels appear to be rising.

6.6 The links between climate change and human activities such as the release of carbon dioxide are clear. Climate change can, in general, be managed effectively only at the international level. However, it is crucial to ensure that the effects of climate change on the marine environment continue to be monitored and further investigated at the local level so that information can be integrated into national and international actions. A discussion of climate change effects is in Box 3A.

6.7 There is at present no general agreement about the degree of physical change that might be acceptable in the marine environment. Table 6.1 shows that climate change affects coastal habitats, plankton species, marine mammals, seabirds and the presence of non-native species. Hence it is reasonable to conclude that, together with the natural atmospheric and hydrographical variability of the oceans, climate change is a major contributor to ecosystem change in the shelf seas of north-west Europe.

Anthropogenic impacts on the seafloor and coastline

6.8 The physical habitats on the sea floor and in coastal environments are under pressure from activities such as oil and gas exploration, construction, aggregate extraction, navigation dredging, fishing, mariculture and litter. Any changes these activities cause to the physical environment are likely to affect the biological communities living in those areas.

6.9 Fishing is probably the activity which has the greatest impact on the sea floor; as shown by Figure 4.2, its impact is widespread but patchy in nature. Most at risk are the areas which are frequently subjected to bottom trawling where there are species that are unable to recover before the next disturbance. In contrast other activities (such as aggregate extraction) tend to have impacts which affect only a small area of the sea floor. Therefore on available evidence, there is no indication of significant structural or distributional changes to benthic communities arising from recent human activities on a regional or UK-wide sea scale. The impacts of new constructions, such as the proposed offshore windfarms, which will have a more permanent presence in the sea, will need to be studied carefully.
6.10 Development of the coast in combination with sea level rise and natural coastal erosion means that many coastal habitats are under threat especially in the eastern and southern parts of the UK. This is known as coastal squeeze. Continual dredging and maintenance of harbours and shipping channels creates hydromorphological changes in the areas of extraction and dumping of the material.

Impacts on the Status of Water Quality

6.11 There are a number of contaminants which influence the chemical status, water quality and cleanliness of the marine environment. These include radionuclides, nutrients, hazardous substances, oil, micro-organisms and litter. Table 6.1 shows the main pressures associated with the contaminants and what our monitoring programmes show about their inputs and effects such as;

- **Radioactivity.** All authorised releases of radioactive materials to air and water are subject to regular monitoring and assessment of exposure. In all cases doses are well within the internationally agreed dose limits for humans. The radiation exposure to marine organisms is highest in the in the north-eastern Irish Sea but even here is unlikely to be great enough to cause adverse effects at the population level. There is also no evidence that population levels were affected when discharges were at least ten times greater than they are today.

- **Hazardous substances.** The industrial, agricultural and general activities of humans result in the release to the environment of a wide range of substances. Some of these are toxic, persistent and bioaccumulative and can, if they reach the marine environment pose a threat to marine organisms. The substances which have been monitored in the marine environment are those for which monitoring programmes have been agreed at European level. In recent years there have been significant reductions in inputs, and concentrations of those substances which are routinely monitored are in all regions are generally below concentrations which may harm marine organisms. Nevertheless, some localised elevated concentrations of contaminants still occur mainly in industrialised estuaries.

- **Oil and hydrocarbon inputs.** Inputs to the different regions around the UK vary. Point source inputs from refineries have been significantly reduced but land-based run-off, from diffuse source inputs have not been quantified. Due to the prevailing wind direction oil inputs from the atmosphere mainly affect the North Sea.

- **Oil from oil spills.** Oil spills by their nature are a risk to the status of the seas. However, management systems are in place to ensure that the effects of any spill is minimised and the evidence shows that impacts do not last much longer than two years.

- **Nutrients.** Direct inputs of nutrients from point sources discharging directly to the sea and atmospheric emissions of nitrogen have reduced by 35% since 1990. However, these direct inputs only account for roughly 25% of all nutrients inputs. Overall inputs from diffuse sources to the sea are unquantified; they present a risk but only in small inshore areas. Offshore waters are generally not adversely affected by land based nutrient inputs.
Litter. Litter on beaches can be a hazard to marine life as well as an eyesore. It is preventable and yet quantities of debris on our coastline are not falling. Types and sources of debris vary across the regions, but 37% is attributable to tourism or beach visitors.

Microbiological contaminants. These are introduced to the marine environment primarily from land-based sources and affect only the coastal zone. Various legislation seeks to protect or improve the quality of bathing waters and areas where shellfish are harvested. We have reduced the number of waters failing the EU Bathing water mandatory standards by improving sewage treatment and infrastructure. These measures have also helped to increase the number of shellfish harvesting beds achieving Class B status or above (the Governments aim). The introduction of microbiological contaminants from ballast water is not quantified in current monitoring programmes.

6.12 The evidence indicates that many of the negative pressures on the marine ecosystem caused by contaminants on the seas around the UK have been significantly reduced in recent years. These include significant reductions in the amounts of hazardous substances, nutrients, oil, faecal bacteria and radioactivity being released into the sea. This has been achieved largely by regulatory pressure to apply better abatement technology and management practices. Furthermore, most uses of the sea are now controlled by licenses underpinned by impact assessments designed to prevent contamination and deterioration of the marine environment.

6.13 This report shows that the state of the sea has responded to these reductions. The open seas are generally not affected by pollution and there are general improvements in chemical and biological water and sediment quality, bathing water cleanliness, and evidence that the undesirable effects of nutrient enrichment are limited to a few small, enclosed areas. However, water quality is still poor and biota are adversely affected in some industrialised estuaries which for decades have acted as entry points for industrial, agricultural and diffuse contaminants. There are also still concerns about the effects of endocrine disruptors, mixtures of chemicals and those chemicals are not routinely monitored.

6.14 In order to address these combined effects we are developing new biological monitoring techniques such as whole effluent assessment, which, when used alongside traditional analysis of single substances, give a much broader perspective on water quality and the impacts of contaminants. But the picture for contaminants will not be complete until monitoring programmes for the persistent, bioaccumulating and toxic (PBT) chemicals recently identified at European level have been agreed and implemented.
The status of marine species and habitats

6.15 The generally positive assessment of water quality status of the UK seas is not matched by the assessment of the status of marine species and habitats. Our seas are still among the most productive fisheries in the world and are able to maintain a wide variety of all kinds of marine life, including fish, a range of marine mammals and a significant number of the world’s seabirds. Land-based nutrients do not generally affect primary productivity, and although biological effects of pollution are locally detectable where there is a known history of contamination, there is no significant evidence to suggest that any contaminants have a serious impact on populations of marine organisms, including fish, in any region around the UK.

6.16 However, table 6.1 sets out some clear and well-documented threats to the delicate balance of the marine ecosystem.

- the sustainability of some fish stocks, especially commercial species such as cod, is gravely threatened by over-exploitation.
- commercial fishing practices also seriously threaten other parts of the ecosystem, particularly through the by-catch of marine mammals and birds and the physical disturbance of benthic communities in heavily trawled areas.
- there has already been a major change in the plankton, both in species and abundance terms since the early 1980s. This affects a large area of the North Atlantic and appears to be linked to changes in the NAO and climate. Plankton play a key role in marine ecosystem functioning and therefore the sharp change in the plankton community is likely to have implications for all elements of the marine ecosystem especially fish stocks;
- we have changed the diversity, dynamics and composition of marine life by the introduction of non-native species and by changes in the relative abundance of species from fisheries;

6.17 The overall effect humans are exerting on the biological environment status or marine biodiversity is still poorly understood and quantified. Moreover, the individual threats posed by each of these factors may be multiplied where they operate in combination and indicators of whole ecosystem change are needed before an accurate status can be given.

6.18 However, our knowledge of the variety and extent of human activities suggests there are likely to be few areas of marine habitats in the UK, which remain unchanged by human activities. Commercial fishing and climate change represent the major threats to marine life. Positive measures are now being taken to manage fish stocks, however, the wider ecosystem effects of fisheries have yet to be mitigated. Minimising the effects of by-catch is also a priority; it remains to be seen if existing measures will be effective.
Emerging and Potential Factors of Concern

6.19 The evidence on which the assessments are based does not cover a number of additional potential pressures and factors which might adversely affect the status of the marine ecosystem. These are not covered in current monitoring programmes and will need to be investigated or kept under observation so that they can be included in appropriate management plans or research programs. Examples are:

- The effects of endocrine disruptors, of new and unmonitored chemicals and of toxic contaminant mixtures on the viability of populations of estuarine and marine species
- The possible impacts of new offshore constructions such as windfarms on local biodiversity
- The possible impacts resulting from climate change which are not currently monitored, including acidification of the seas.
- The impacts of major new accidents such as large oil spills or radioactive discharges

6.20 It will also be essential to remain vigilant against the risks of unpredictable “wild cards” such as:

- Ecosystem regime shift, in which a key component of the ecosystem changes irreversibly, with significant knock-on effects on other ecosystem processes
- Fisheries collapse, involving loss of major stocks and ramifications for the food chain
- Tsunamis and other low frequency, high impact natural events.

General Conclusion on the Status of the Seas

6.21 The general picture that emerges from the evidence (Table 6.1) is that the UK seas are productive and support a wide range of fish, mammals, seabirds and other marine life. The open seas are generally not affected by pollution and the levels of monitored contaminants have decreased significantly. The main contamination problems which are identified are in part due to the legacy of the past and are generally observed at higher levels in industrialised estuaries or areas local to the activity.

6.22 However, human activity has already resulted in adverse changes to marine life and continues to do so. For example, widespread commercial fishing practices threaten many fish stocks by over-exploitation and damage sea floor areas. There is also evidence that the marine ecosystem is being altered by climate change: for example sea temperatures are rising and the distribution of plankton species is changing. These changes pose a real threat to the balance and integrity of the marine ecosystem.
6.23 Generally the evidence summarised in this report, which mainly derives from existing monitoring programmes covers only some of the physical processes, human activities and marine life which contribute to the status of our seas. These are insufficient to enable the status of many elements of the marine ecosystem to be assessed. This is why a number of the status boxes in Table 6.1 are coloured orange. There remains a general lack of knowledge about the status of offshore areas, which have been infrequently sampled due to the cost of ship-based monitoring.

6.24 Consequently, given the limitations in available information our overall assessment should be regarded as provisional. Nevertheless, we are confident that the major threats and issues have been identified and that this integrated assessment has given us a basis from which to assess data gaps, deliver improvements and detect adverse changes. But it is only the beginning of a long process which will develop further as our overall understanding and monitoring of the marine environment increases.

Lessons learnt and forward look

6.25 The preparation of this first integrated report represents the start of the much longer process of developing our overall understanding of the marine environment and formulating policies to respond to identified problems. A number of lessons can be learnt from the process of gathering the evidence and compiling the report itself and the following actions are suggested to address the issues. Although they overlap, they can broadly be divided into two main categories:

Knowledge of the marine ecosystem

A number of gaps in knowledge have been highlighted earlier in this chapter. These gaps are evident both in the basic data and in the tools available for assessing the data. There is a need to develop benchmarks against which progress towards the vision of clean, safe, healthy, productive and biologically diverse seas can be monitored. Action 1 would involve the development of marine ecosystem indicators for this purpose. Action 2 would be to use the Marine Monitoring Coordination Group to coordinate the current marine monitoring activities, to identify gaps and to develop a more comprehensive approach to UK Marine Monitoring. Action 3 would be to promote marine research into the more fundamental gaps in basic knowledge that the process has revealed.

Institutional issues

Those of a more institutional nature dealing with how we can better optimise the considerable efforts and resources needed to assess the state of the seas thoroughly and make best use of scientific evidence to underpin policy and marine management decisions required to reach the overall aim of safeguarding our ecosystem. Action 4 would involve the pooling of scientific expertise and ensuring that the relationship of work on specific issues to the broader marine environment is properly understood. Action 5 involves working in partnership to establish
a national framework for managing marine data and information based on the principle of “capture once and use many times. Action 6 would be the development of a better understanding of how climate change affects the marine environment. Finally Action 7 would be steps such as the Government’s proposed Marine Bill to facilitate the application of ecosystem approach to sustainable development.

Box 6A Specific Actions

The following specific though overlapping and interrelated suggested actions arise from the lessons learnt whilst compiling this report.

Action 1: Development of marine ecosystem indicators to enable the state of the seas to be more precisely measured and progress towards the vision to be monitored

Making an assessment of the state of the marine environment raises the question of what constitutes a healthy or productive sea. The vision set out in Safeguarding our Seas gives a clear indication of our aspirations, but it needs to be expressed in more precise scientific terms in order to judge accurately how close we are to achieving the vision and to measure progress towards it over time. We need clear agreed benchmarks for assessing what “state of the seas” we are aiming for and what “clean”, “safe”, “healthy”, “productive” and “biologically diverse” seas really means. This is a huge challenge, given the range of aspects of the marine environment, which must be covered, and the lack of scientific understanding of some of the interactions. While there has been considerable work both within the United Kingdom and within Europe to address these issues, much remains to be done. Chapter 2 describes the state of progress on the development of ecosystem indicators, which might provide the best means of assessing the state of our seas.

We will be taking this forward both through our research programmes and through participation in the development and application of the European Marine Strategy which is undertaking a similar exercise at European level. It will be essential that scientists and policy makers work closely together in this process.
Action 2: Evaluating and revising our current Marine Monitoring programmes

Current marine monitoring programmes, which are designed to demonstrate compliance with the requirements of current national and international regulations, are sector-based. As this report has shown, they do not provide sufficient evidence to provide a robust assessment of the overall state of the marine ecosystem.

A Defra led Marine Monitoring Coordination Group is taking forward work to redesign the collection, co-ordination and reporting of marine data. The Group is drafting an action plan with proposals for monitoring how the ecosystem is changing in response to both long-term and immediate human induced disturbances. The Government departments and agencies concerned are committed to working closely with this process to ensure that the various marine monitoring activities undertaken in UK waters are coordinated and fit for purpose. The Group will assess the gaps and explore how to move towards a more pragmatic risk-based approach to monitoring. It will need to consider the resource implications of its proposals and will aim to work internationally (for example in the context of the WFD, which sets ecological quality targets) to ensure that scarce resources are targeted efficiently.

Action 3: Marine Research

Attempting to apply the ecosystem approach has shown that there is a rather limited understanding of the marine ecosystem and its various components, how it can be defined, how it functions and what indicators are needed to see whether it is in good shape. The following is an initial list of science evidence gaps identified from this report.

- a set of tools to help demonstrate whether, taken together, the various human uses of the sea are having adverse effects on the marine ecosystem.
- the effects of contaminant mixtures on marine species and whether such mixtures affect the long-term viability of populations.
- impacts arising from changing uses of the sea such as new offshore developments of windfarms, extracting aggregates from new areas and new fishing regimes and practices.
- the degree of human impact that the marine environment can safely tolerate. This is essential in the light of the Government’s policy to allow sustainable exploitation of marine resources. This is a significant challenge which will need better evidence and a better understanding of ecosystem health. These questions could be partially addressed by the development of ecosystem models.
- the lack of a basic habitat map of UK waters hinders the assessment of the current ecosystem ‘state’ and the effects of impacts on a wider scale. Such a map would provide a fundamental spatial planning tool.
- cumulative impacts on marine ecosystems and the links between cause and effect which hinders the development of appropriate management actions.
natural variability of ecosystems and distinguishing this from anthropogenic pressures.

longer term changes to ecosystems associated with pressures such as climate change and what can be done to adapt to such changes

the impacts which over-fishing has on the food web and overall ecosystem stability.

These need to be addressed by coordinated work through marine institutes and various marine research programmes

**Action 4: Capturing ‘knowledge’**

The evidence for this report was gathered from a wide variety of sources (see Annex 1) but gaining access to knowledge and ‘information’ is sometimes more difficult than generating the raw data. Better use needs to be made of the expertise and information available in all of the relevant UK institutions which deal with the marine environment, so that it can be more effectively integrated into policy making. This was also recognised in the recent “Net Benefits” report on the future for UK fishing from the Prime Minister’s Strategy Unit. This called for research councils, universities and government agencies to pool their expertise to deliver the knowledge and understanding needed to progress ecosystem management, particularly for fisheries.

There is a need to look at ecosystem processes at all levels and over pertinent time scales in order to optimise the gathering and dissemination of information and to build more transparent routes for transferring expertise and knowledge of marine science to policy and decision makers. There is also a need to share ideas of best environmental practice. To facilitate this, a national framework is needed to bring together the various pieces of science to complete the ecosystem jigsaw and thus best help advise on policy for marine stewardship. This requires close co-operation between the Government, the marine agencies and advisors and the research councils as well as with the wider marine science community. The Government will encourage and facilitate such joined up working so that the capacity of the various organisations concerned to deliver data and knowledge required for the assessment of the state of the seas is maximised. What is needed is not only better data management but also more consistent and coherent ways of interpreting data that address the state of the ecosystem rather than just the impacts of individual activities.

**Action 5: Data and Information Stewardship**

Fundamental to Action 4 is the way marine data are managed. A lot of marine environmental data held by different organisations could be used much more effectively if the information were more easily available. To enable the transformation of marine data and information into evidence and knowledge the Government is supporting the development of the Marine Data and Information Partnership (MDIP). MDIP comprises organisations working in partnership across Government, non-departmental public bodies, research institutes and the private sector to:
• Establish an enabling framework for managing marine data and information: ‘capture once and use many times’
• Establish Data Archiving Centres
• Provide guidance on managing marine data and information including the development of standard protocols and procedures.

**Action 6: Marine Climate Change Impacts**

A detailed evaluation of the effects of climate change on marine ecosystems, which is a new and a developing area of study, has not been carried out in this report. However, the threat of climate change is becoming more certain. Ecosystem effects occur as a result of both natural and anthropogenic climate variations. Partly because of a lack of baseline monitoring data, it is difficult to separate out the effects of these two influences. It is likely that the state of the seas will be significantly affected by increases in sea temperature and sea levels and changes in the North Atlantic Oscillation (NAO). Significant impacts are predicted both on species and habitats and the way ecosystems function. It is therefore necessary to develop a better understanding of how climate change affects the marine environment, and ensure that this is integrated with the broader work and research. The Government intends to work in partnership with research and monitoring organisations to understand the cross cutting impacts of climate change in the marine environment. The formation of a Marine Climate Change Impact Partnership (MCCIP) also goes some way towards Action 4.

**Action 7: Marine Stewardship in Action**

Safeguarding our Seas (2002) adopted an ecosystem approach to the management of known activities in the marine ecosystem. Charting Progress considers in an integrated manner all the overall anthropogenic impacts on the marine ecosystems. The management of our seas must also recognise and adapt to longer term trends and variables which cannot necessarily be controlled. There is a need to address existing local problems which are caused by known human impacts such as polluting discharges or physical disturbance arising from dredging/disposal and fisheries, and to consider further how best to address the wider ecosystem damage caused by fishing. We need to bring the arrangements for managing marine activities more into line with the ecosystem approach.

To meet some of these policy challenges, the Government will bring forward a Marine Bill. One area, which can be improved, is our system of consenting marine developments that can have major impacts on ecosystems. This has grown in a piecemeal fashion over many years and is in need of modification. A pilot is underway in the Irish Sea to test the feasibility of marine spatial planning. We will work closely with the National Assembly for Wales, the Scottish Executive, and the devolved administration in Northern Ireland to consider what approaches may be suitable in each of their countries. Where they have responsibility for the management of their territorial waters it will be for the devolved administrations to determine the need to bring forward any new legislation.