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The practical implementation of marine spatial planning - understanding and addressing cumulative effects

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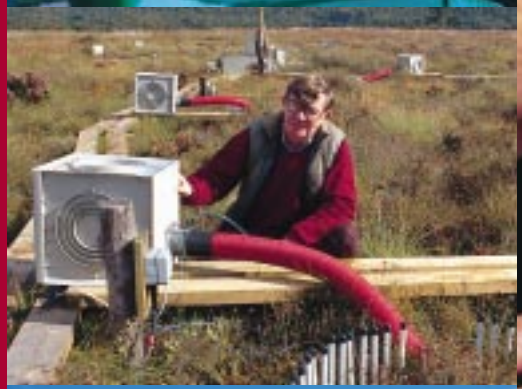

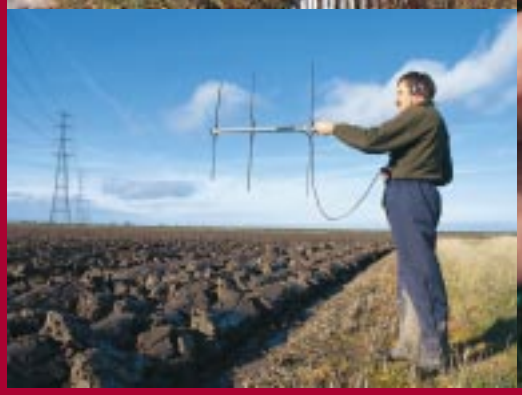

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The practical implementation of marine spatial planning – understanding and addressing cumulative effects

Report of a workshop held 4 December 2003, Hilton International, Stansted Airport, UK

A report to inform Defra's Marine Stewardship Process

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Executive Summary

Introduction and background

Some observers advocate that Marine Spatial Planning could improve our ability to assess and make decisions about cumulative effects in the marine environment. However, there has been little consideration of whether this is the case and how it could be achieved in practice. In response, The Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Countryside Council for Wales (CCW) and English Nature organized a workshop to develop ideas for the practical implementation of marine spatial planning, focused on cumulative effects. Participants included some representatives from government (regulators and policy makers), statutory advisors, consultants, NGOs and limited industry representatives.

Purpose and approach

The workshop considered two perspectives, essentially “What can the evaluation of cumulative effects offer to decision makers and to the spatial planning process” and “What can spatial planning offer as a tool to help make decisions about managing cumulative effects”. The outcome should inform a number of initiatives and programmes, not least those relevant to Defra's Marine Stewardship process.

The workshop was based upon a small number of recent practical examples of the potential use of 'Cumulative Effects Assessment' (CEA). These were used to discuss the process involved in undertaking such assessment before concentrating on three key components - spatial scale, temporal scale and consequence (sensitivity, vulnerability, importance and carrying capacity). The general discussion considered the relevance of Marine Spatial Planning to cumulative effects but also the relationship between these, Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA) and the development of spatial planning in its own right.

Discussion and conclusions

Participants felt that this was one of the first occasions that the debate about Marine Spatial Planning had moved from the conceptual to the practical, using CEA as a focus or 'test' of what Marine Spatial Planning might achieve. Not surprisingly, the workshop did not answer all questions posed and highlighted further questions. However, a number of conclusions could be drawn.

Cumulative assessment process

- The fundamental components of a cumulative assessment process are spatial data describing the activity and the key environmental components that are being assessed. Subsequent analysis must then define the scale and intensity of interactions between these, taking account of sensitivity and vulnerability.
- Such analysis relies on a wide range of information sources including expert judgement, meta-analysis and models, supported by Geographic Information Systems technologies and procedures.

- Despite the increasing quantity of literature on cumulative assessment, there is a clear need for better, targeted guidance on CEA for developers and regulators operating in the marine environment.

Scale and resolution

- Spatial and temporal boundaries will differ between various types of Assessment and Plan, but in principle for CEA it should mainly be dependent on the activity and/or environmental component.
- In almost all cases CEA will be driven by a 'tool' such as Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA) or Marine Spatial Planning in relation to either a project (activity or development) or plan. Any such project or plan will encompass a range of environmental components, making it difficult to define a single boundary based on the latter. Therefore in practice the project or plan will set the boundary.
- In general, the larger the spatial scale being considered the longer the period of time that needs to be considered.
- In many cases the resolution of data, whether temporal and spatial, is limited by what data are available rather than by the limits set by the particular assessment.

Consequence

- It is not possible to score combined sensitivity and combined vulnerability, in relation to the response of an environmental component to a single external factor, but it is possible to rank components on a relative basis using best judgement.
- Where possible assessment of cumulative effects should start from the perspective of environmental components rather than activities. However, in practice it is difficult for individual developers or sectors to do this in EIA or SEA. It is more likely that it could be done in spatial planning. Carrying capacity is a useful concept in theory but very difficult and complicated to define and use in practice, particularly when applied to a range of environmental components and/or over the spatial scale likely to be covered by a spatial plan.
- Carrying capacity is further complicated because a variety of influencing factors, including natural change, human use and societal values, change over time.

Relationship between Marine Spatial Planning, SEA, EIA and CEA

- Marine Spatial Planning, SEA and EIA are complementary tools in assessing and addressing cumulative effects. None is 'better' than the other, rather it depends on the scale and what is being assessed.
- Moving from the more specific scale of an EIA to the broader, regional scale of a spatial plan, the ability to predict and therefore assess cumulative effects becomes more complex and less certain. However, spatial planning should improve the ability to manage and avoid such effects.
- Whilst recognising the benefits of sectoral SEA, Marine Spatial Planning offers additional benefits including integration of clearly articulated environmental

objectives with economic and social objectives, reconciling conflict between different sectors of human activity as well as between the full range of human activities and the environment, and bringing more certainty to developers and others earlier in the decision making process. Ideally, a spatial plan would be produced, subject to SEA and this would then provide a context for any further, sectoral SEA required. In reality, Marine Spatial Planning needs to build on sectoral SEAs already undertaken. Further, Marine Spatial Planning will take several years to establish and in the meantime much could be achieved by undertaking SEA of particular sectors, such as those completed for the hydrocarbon and renewable energy sectors and those that may be undertaken for sectors such as fisheries, which would facilitate the development of a spatial planning system.

- A commitment to Marine Spatial Planning might give better focus and impetus to tackle long standing issues such as providing clear environmental objectives at a broad scale or addressing prioritised data gaps.
- In the context of spatial planning, rather than management of a particular sector, there is a potential role for areas or zones where no activity takes place as some form of 'reference' and/or 'insurance', but this requires much more discussion.
- A lack of data should not prevent progress being made in exploring and developing marine spatial planning through testing it in practice, learning from the experience and adapting accordingly.
- Whilst it was welcome that there were representatives from industry, we need to ensure more industry and user group participation in the debate about marine spatial planning.

It is difficult to separate discussion of cumulative assessment from that of broader planning and environmental assessment. All these topics are complex and inter-linked. There is a danger that marine spatial planning will be seen as a means for all sectors to achieve their objectives, which is unlikely in practice. This is one of the reasons why the Marine Spatial Planning debate needs to move on to how it would work in practice and to better involve the full range of stakeholders. This is unlikely to be achieved without undertaking a practical trial.

Next steps

A number of next steps were identified in relation to:

- *CEA* - produce further guidance on CEA (which should include link to Marine Spatial Planning), further discussion and guidance on carrying capacity.
- *Data* - complete current government reviews of marine data management as soon as possible, and take urgent practical steps to collate and make widely accessible marine data from a range of sources, including but not restricted to public agencies.
- *Marine Spatial Planning* - provide further guidance and example of environmental objectives, undertake trial project to test and develop Marine Spatial Planning in practice at an appropriate scale, ie regional sea.

Contents

1. Introduction

At a national and international level the UK is committed to investigating some form of Marine Spatial Planning to assist in the planning and management of marine resources. It is anticipated that marine spatial planning would offer a number of benefits, including improved coordination between sectoral activities and reconciling potentially different and competing interests. It should also ensure that UK commitments to nature conservation are central to the planning and management of human activities. Some observers advocate that Marine Spatial Planning could improve our ability to assess and make decisions about cumulative effects in the marine environment (see for example Defra 2002, Birdlife International 2003, English Nature 2003). However, there has been little consideration of whether this is the case and how it could be achieved in practice.

Cumulative Effects Assessment (CEA) was a key issue discussed at a recent UK conference on "Spatial Planning in the Coastal and Marine Environment" (*CoastNET* 1 October 2003). The conference was organised partly to take forward Defra's commitment in *Safeguarding our Seas* (Defra 2002) to explore the role of marine spatial planning. At the end of the conference, it was noted that CEA was one of the key practical issues that required largely professional (rather than political or social) input. A number of 'next steps' were suggested including the development of methods or tools to analyse, interpret and present spatial data to inform assessment of cumulative effects and to assist decision makers. There have been a number of recent attempts to further develop such methods, both in the process of Strategic Environmental Assessment (SEA) and elsewhere (Oakwood 2002). Given these developments, and the interest in exploring the practical aspects of marine spatial planning, it was agreed that revisiting these various approaches and agreeing on a practical way forward would be timely.

There was a proposal at the *CoastNET* conference to hold a small technical workshop to explore a practical way forward on these issues. In response, The Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Countryside Council for Wales (CCW) and English Nature organised a workshop to develop ideas for the practical implementation of marine spatial planning, focused on CEA.

The workshop was based upon a small number of recent practical examples of the potential use of CEA, and the various methods that had been developed (eg Oakwood 2002, BMT Cordah 2003). It also took account of an increasing international literature that provides other examples of CEA, and suggested frameworks for practical application. A range of organisations were invited to the workshop. Participants included some representatives from government (regulators and policy makers), statutory advisors, consultants, NGOs and limited industry representatives (Annex A).

This report is the main output of the workshop and is based on points made during the discussions. We acknowledge all the contributions made by participants during the workshop and subsequent drafting of the report, although responsibility for the report lies with the authors. The report is principally aimed at assisting the Marine Stewardship process within the UK, particularly the practical development of marine spatial planning. Given the interest in Marine Spatial Planning, and CEA, nationally and internationally, we hope it will be of wider interest and will inform a range of initiatives including those being developed by OSPAR and in relation to the EU Marine Thematic Strategy.

2. Background

The Government's vision "to provide for clean, healthy, safe, productive and biologically diverse oceans and seas" as advocated in '*Safeguarding our Seas*' (Defra 2002), focuses on the need for an ecosystem approach and improved governance through integrated stewardship of the maritime environment. This requires better integration of marine protection objectives with goals for sustainable development and economic growth, and recognises that in the past, management of the coasts and seas was often fragmented and driven by short-term economic gain. Improved co-operation in the spatial planning processes for the marine environment is one important mechanism for change.

There is no current statutory or single, widely recognised definition of "spatial planning" let alone "marine spatial planning". A number of definitions, from existing sources or new proposals, have been debated. There seemed to be wide acceptance for the definition suggested by Defra at the *CoastNET* conference, with amendment discussed in the conference, ie:

- "*Marine spatial planning can be seen as a strategic plan (including forward looking and proactive) for regulating, managing and protecting the marine environment, including through allocation of space, that addresses the multiple, cumulative and potentially conflicting uses of the sea*".

This definition informed the discussion at the workshop reported here. However, the definition continues to be debated (see for example Tyldelsey & Hunt 2004) not least because it is intimately related to what a marine spatial plan does.

Cumulative effects assessment (CEA) has been defined in a variety of reports and publications. At the *CoastNET* conference the following definition was put forward

- "*The effects on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable actions regardless of what agency or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time*" (Council on Environmental Quality 1978).

This definition was accepted for the purposes of the workshop but noting that it should include beneficial as well as adverse effects to the environment.

Cumulative effects assessment or some form of assessment of cumulative, synergistic or in combination, effects is required in the UK under the terms of the Habitats, Environmental Impact Assessment and Strategic Environmental Assessment Directives. However, despite the acknowledgement that CEA is an important element of decision making, there are few practical examples of it being applied in a meaningful manner in the marine environment.

3. Purpose of workshop

The focus of the workshop was the difficult but key issue of CEA, and how to undertake spatial data analysis to inform decisions about potential conflict between multiple human

activities and nature conservation. CEA is also concerned with conflicts between different human activities but this aspect was not included in the workshop.

Whilst such a discussion could be undertaken solely from the perspective of the information and tools needed to understand cumulative effects and inform decision makers, it was considered important to include the broader context of the decision-making process, and specifically marine spatial planning.

The workshop considered two perspectives, essentially "What can CEA offer to decision makers and to the spatial planning process" and "What can spatial planning offer as a tool to help make decisions about managing cumulative effects".

4. Objectives

The workshop had three key objectives:

- To examine key components relevant to CEA and provide further guidance on these;
- To examine the methods currently used (including the overall process, commonality, and techniques for integration of spatial data), to make decisions on cumulative effects;
- To assess the links between the first two points and marine spatial planning, ie how CEA assessments could contribute to spatial planning and how spatial planning could help inform the CEA process.

The outcome of the workshop, based on the objectives, should:

- Contribute to the work outlined in the Defra Marine Stewardship Report;
- Contribute to ongoing Defra research programmes involved in the study of the ecosystem approach to management of human activities;
- Inform initiatives within relevant agencies, such as English Nature's developing Maritime Strategy, and inform advice given by CEFAS, JNCC and the country agencies, for example to regulators.
- Suggest further work, case studies or projects;
- Provide the basis for further, more policy-related discussions on the efficacy of marine spatial planning *cf* other systems for making relevant decisions.

5. Workshop structure, agenda and discussion groups

There are a number of aspects to CEA and, therefore, options for structuring detailed discussions. It was decided to address these at the start of the workshop to bring out any key practical lessons, commonality, and differences (see Annex B; all presentations are included in Annex C). This was done by briefly reviewing a number of approaches to assessing cumulative effects based recent examples in UK waters, ie:

- The methodology used to prepare the UK offshore windfarm Strategic Environmental Assessment (SEA), undertaken by BMT Cordah.

- The methodology applied in Liverpool Bay, UK, by Oakwood Environmental as an exploration of a potential CEA methodology carried out for the Countryside Council for Wales.
- An approach to CEA building on the progress made with assessing the sensitivity of marine landscapes in the Irish Sea, UK, by MarLIN (Marine Life Information Network).

Following on from this, the workshop concentrated on three key components of CEA, spatial scale, temporal scale and consequence (sensitivity, vulnerability, importance and carrying capacity) through 3 parallel discussion groups. Each group was posed a number of questions to structure their discussion (Annex D).

The final session focussed on how a practical methodology for CEA could be incorporated into a spatial planning process, the links between the different tools of EIA, SEA and Marine Spatial Planning in relation to CEA, and what additional work on CEA was required.
It was considered helpful to draw on a limited set of real examples and data to inform the discussions. Relevant material was provided for the workshop, and discussion groups, to use as appropriate (see Annex E). The aim was to assist consideration of key questions and concepts rather than to undertake an assessment of the cumulative effect of the selected activities.

6. A potential framework for the assessment of cumulative effects of human activities on the marine environment

6.1 Introduction

This section brings together a range of new ideas on CEA as well as drawing on progress already made and the discussion in the first session of the workshop. It outlines a generic framework for cumulative effects assessment (CEA), and at the same time clarifies the steps that will be necessary to implement the framework.

The fundamentals of any CEA process are:

a) Spatial data representing the extent, both temporal and spatial, and intensity of human activities;

b) Spatial data representing the key environmental components such as habitats of conservation interest or biological components that act as indicators of human impacts;

c) Clear analysis of how (b) is affected by (a), whether the analysis is based upon expert judgement, meta-analysis, or empirical models; and

d) Geographic Information Systems technologies and procedures to:

   i. store (a) and (b)
   ii. model how (a) affects (b) through information in (c), and
   iii. present the final outputs of the CEA process.

A clear understanding and precise definitions of all 4 components is required if a robust and defensible approach to CEA is to be developed. Further details of these components are provided below.

6.2 Spatial data representing the extent, both temporal and spatial, and intensity of human activities

The 2003 SEA for offshore wind (BMT Cordah 2003) highlighted the difficulty of implementing CEA with insufficient data to adequately describe the extent and intensity of all human activities that impact the marine environment and how they interact. Examples of human activities that are often not represented by adequate data include recreational use of marine waters, outflows from discharge pipes, and terrestrial run-off. In addition, data may not be in a form that is adequate to prepare a sound assessment of the extent and intensity of the impact the activity may cause. For example, fishing activity can cause widespread modification of seabed environments, and yet the data used to describe fishing intensity and location are still relatively imprecise.

When collecting data describing human activities the real interest is not the activity itself but the specific impacts it causes. The physical, biological and chemical impact effects associated with a broad range of human activities has been undertaken by MarLIN's matrix of human activities (http://www.marlin.ac.uk/PDF/ISP_Consult_Paper_Revised_Screen.pdf). Whilst this matrix provides a useful overview of human impacts in coastal environments, it is limited with respect to CEA implementation because the spatial and temporal component of each individual activity, its intensity and duration and the impacts caused, are not generic and must be clearly defined. For example, although smothering is caused by a number of different human activities, the degree of smothering effect will be controlled by a combination of environmental factors, such as the species or habitat affected, and the intensity of the activity. As an impact, smothering cannot therefore be defined in generic terms.

Problems can also arise when converting human activity data into a digital representation of the extent and intensity of the associated impacts. For example, Oakwood Environmental's CEA case study in Liverpool Bay was based on a relatively coarse grid consisting of spatial units measuring 2 x 2 km. The size of these units represented the maximum resolution at which human impacts could be assessed. Thus, to use the same example as before, the impact from smothering was considered 'high' if within 2 km of the activity, 'medium' if between 2-4 km, and 'low' if between 4-6 km. Smothering of the seabed can be caused by a range of different activities, and the nature of the impact will be different depending on the species or habitat affected, the nature of the underlying substrate, the prevailing tidal streams, and the plume content, size and extent. Therefore, smothering cannot be considered a generic impact that operates over predefined spatial and temporal scales, but instead will be highly dependent on the activity and the prevailing environmental conditions.

The issues outlined above highlight the need to:

- Identify and capture sufficient data on the impact of key human activities to allow a complete assessment of cumulative effects.
- Define ways of representing human activities both precisely and accurately so as to obtain the best possible estimates of the intensity and temporal and spatial extent of the associated impacts.

6.3 Spatial data representing the key environmental components of conservation interest or that act as indicators of human impacts

Having obtained all the necessary data to describe human activities and their impacts, data is then needed to describe the key environmental components that may be affected. The degree of impact from an activity will relate directly to the type of environment being impacted. Estimating and quantifying impacts therefore requires adequate spatial data describing the marine environment according to some agreed systematic, such as the EUNIS classification system or the marine landscape system recently developed in the UK by JNCC for the Irish Sea Pilot (Golding *et al* 2004). The agreed system must allow all environmental components to be represented in their true spatial context. The system must therefore be capable of representing the area occupied by a species, assemblage, or habitat as one or more classification units. A good example is given in the Liverpool Bay case study by Oakwood Environmental where one of the environmental components of concern was the habitat used by the common scoter, a sensitive species of sea duck. Mapping of scoter habitat was achieved using two marine biotopes taken from the Marine Nature Conservation Review's biotope classification system (see www.jncc.gov.uk). Problems would have arisen if the habitat used by common scoter was not adequately represented by a specific biotope(s), and this may occur in situations where the lowest level of classification is still too coarse. As a result, a hierarchical classification system based on detailed representations of the marine environment is preferable to one based on coarse generalisations.

In practice, the level of detail of biological information used will be dependant upon the level at which we are able to assess the likely impact of activities with any degree of certainty. Bearing in mind the implicit requirement of CEA to estimate (or better still, quantify) environmental impacts of human activities, the environmental classification system would ideally require information on the impact from specific activities on specific classification units. The recent marine landscapes classification derived from the Irish Sea Pilot work is a good example: what can we say about the impact of bottom trawling on individual ecological units? If insufficient empirical information is available, or cause and effect cannot be inferred, it may be impractical to consider such systems of classification.

The issues outlined above highlight the need to reach consensus and adopt a classification system that:

- Partitions the marine environment into ecologically coherent units
- Can be used to adequately represent the spatial distribution of key environmental components of concern (for example benthic habitats, marine mammal or seabird distribution)

- Can be related to information on the effects of human activities on the environment, either through empirical data or cause and effect inference

6.4 Clear definitions of how the biological environment (6.3) is affected by human activities (6.2), whether the definitions come from expert judgement, meta-analysis, or empirical models

Once all the data for human activities and environmental components have been assembled, the two need to be related in terms of how the impacts arising from human activities affect the relevant environmental components. How this is achieved will largely depend on the type of information available to describe, and possibly quantify, the impacts arising from human activities. Ideally, the interaction between a specific human impact and a biological component will have been quantified in some way, whether through experimental studies or field investigations. It likely, however, that most impacts will lack quantitative data and will have to be described in subjective terms based on expert judgement. This does not need to cause complications in the overall process of CEA as long as impacts are described or quantified in terms of relative rather than absolute units.

For example, there may be sufficient empirical data to quantify the direct loss of benthic fauna from aggregate dredging and also for subsequent rates of recovery, whereas the same might not be true for the same impact caused by fishing with beam trawls over a range of different fishing intensities. However, direct losses to benthic communities from these two activities can be combined to assess cumulative effects if the impact from both is presented in relative terms, ie on a scale of 0 to 1. By adopting this approach, the progress and implementation of CEA does not need to be hampered by a lack of empirical data with which to quantify impacts. It also allows impacts that can be described quantitatively to be included and highlights activities and impacts for which little is known except by subjective inference.

These issues highlight the need to:

- Describe the impacts caused by human activities, where these descriptions are based on expert judgement and where possible, empirical observations.
- Include in those descriptions a reference to how the impacts relate to different seabed environments.

6.5 Geographic Information Systems (GIS) technology and procedures

The final stage in the CEA process involves the use of GIS. GIS is required to store the data describing human activities and associated impacts in their true spatial (and, if required, temporal) context, and for spatial data describing the various environmental components of conservation interest. GIS could also include predefined models that combine all the descriptions of impacts on environmental components.

Digital representations of human activities and environmental components should be stored in an appropriate data format and represented as precisely as possible in terms of the spatial area they occupy. For example, all fixed constructions, such as pipelines and oil rigs, should be stored as vector polygons instead of lines and points, neither of which occupy physical space. Fishing and shipping activity on the other hand is a non site-specific activity and is

best represented using raster data where the grid cell size is set to the highest resolution at which the data can be sensibly represented.

Regardless of the format the data is stored in, it is likely that prior to using a CEA model, all data will be converted into raster format. Data stored in vector format will have to be represented in raster form at a suitably high resolution to minimise the effects of error propagation that may result from the pixellation of boundaries of spatially discrete features. Adopting a grid based approach means that geographic boundaries do not have to be defined early on in the CEA process, as all human activities are represented using the best possible data and at the highest level of accuracy and precision. This increased flexibility would provide a valuable development of the methodology adopted by Oakwood Environmental in their Liverpool Bay case study whereby the geographic limits were first defined and the area of study subsequently broken down into a spatial grid.

The use of GIS as the technological framework highlights the need to:

- Prepare data in the correct format, and to the lowest level of resolution,
- Use an appropriate raster format for presentation of the datasets describing human activity or the biological environment, and gridded at the highest level of accuracy or precision that he data will allow.

7. Discussion group summaries

7.1 Introduction

The three parallel discussion groups focussed on key points highlighted in section 6, namely the spatial and temporal scales that might be appropriate for CEA, and the consequences of human activity on the marine environment. There was substantial overlap between the three discussion groups. As a result all relevant points on carrying capacity are recorded in one section and many of the points made in relation to marine spatial planning are included in the next, more general, section.

Temporal issues

7.2 What should be the temporal boundary for CEA?

7.2.1 Timescale

The timescale over which CEA is undertaken is crucial. The aim of CEA is to understand the situation now relative to the past and assess changes into the future, to inform further developments in known sectors and novel sectors in the future. Consequently, it is difficult to prescribe a fixed time period. Generally it was considered worth undertaking CEA for any retrospective time period.

7.2.2 Looking forward

CEA should include the current situation and include activities to an appropriate point in the future. CEA should include (reasonably) foreseeable projects. How far forward into the future CEA should extend depends on factors such as:

- Duration of observed or inferred impacts
- Timing of known or planned projects
- Life span of plan/development
- Spatial scale (larger area generally requires longer timescale).

7.2.3 Looking back

In considering the current situation it should also include an element of 'hindcasting' to understand the context of impacts and changes over time. How far back should an assessment go? This will depend, amongst other things, on:

- The duration and extent of the impacts of the activity being considered
- The objectives of the CEA
- Other relevant objectives
- Time of designation of conservation sites in relation to the developments
- The limits of available datasets.

It is important to understand what use can be made of this contextual information. An historical perspective could be obtained by comparing present status relative to that observed during some period in history. Alternatively, if there are clear objectives for management, possibly expressed within a plan, these may guide the historical perspective required. In order to take into account historical information we also need to understand or consider natural change ie how much an environment would have changed anyway without human intervention or impact. However, it is recognised that this will usually be difficult to achieve.

If the assessment is concerned with the effect on a nature conservation site it might be appropriate to consider the date of designation as a starting point. For example, many Special Areas of Conservation were identified in the mid 1990s (Habitats Regulations brought in 1994) with the general assumption that, unless demonstrated otherwise, sites (or the features for which they were selected) were probably in favourable condition. However, in some cases the current condition, or condition at that time, does not appear to be, or have been, favourable. An alternative would be to refer to the objectives and targets in Biodiversity Action Plans, some of which give historical references, eg offset loss of habitat X over the last 50 years (see examples in UK Biodiversity Group 1999).

In the example of SACs, there is at least some information on the condition at time of selection against which to make an assessment. In many cases, however, there are difficulties in researching or finding historical data and these limit how far back CEA may consider.

Instead, in practice CEA is undertaken by considering the current situation and how this will change in response to new or further activities. The key benefit of looking back is then to put current and future assessment of the likely effect of activities into context. Looking back should help to understand broad trends and actual impacts of previous developments.

7.3 Temporal resolution

There was little discussion of temporal resolution except to note that the resolution required or achievable will generally increase with smaller projects of shorter duration. Resolution will also relate to the nature of an effect or impact being assessed, particularly the intensity and the likely duration of the impact.

7.4 Timeframe in relation to spatial planning

Participants did not make any firm recommendations on the duration of a plan, except to note that there will probably be a fixed period for the duration of a plan but it is difficult to define such a period for CEA. A key issue to consider is the needs of industry and the fact that different industries are likely to forecast over different time periods, sometimes over several decades. Many thought it necessary and reasonable for industry to state what they foresaw for a 'significant' period ahead. On the other hand, for obvious commercial reasons, industry may be reluctant to reveal their plans except at the larger, regional sea scale.

Spatial issues

7.5 What should be the spatial boundary for CEA?

The spatial boundary of the assessment is highly dependant on:

i) the nature of the activity/development/project/plan
ii) the environmental component being considered such as a habitat or species
iii) pathways by which (i) and (ii) interact, such as sediment transport, currents etc.

For example, a rare benthic species would require a relatively small geographic area for assessment whereas a migratory species would require a larger area. Assessment of a pollutant hazard associated with a development might need to encompass the area represented by one tidal excursion. Assessing the effect of human activities on a restricted area of *Sabellaria* reef would encompass only a relatively small area, while assessing the cumulative effects on migrating birds could extend beyond national borders.

Participants therefore considered it difficult, and indeed unnecessary, to standardise or give specific advice on the spatial boundaries for CEA. The examples discussed (Oakwood Liverpool Bay study, Irish Sea Pilot and North Hoyle windfarm) were all considered valid. The following paragraphs highlight links to existing activities considered at a range of scales and how CEA could apply.

7.5.1 CEA and site-based Environmental Impact Assessment

It should be possible for an EIA of a single activity or development, with a good understanding of the hazards associated with it, to define a spatial boundary for CEA with confidence. Where the assessment is restricted to a Marine Protected Area, eg an 'appropriate

assessment' in relation to a Special Area of Conservation (SAC), the boundary is already defined although this may require taking account of factors beyond the protected area.

7.5.2 CEA and broader scale Strategic Environmental Assessment

At the broader scale likely to be covered by SEA, it is possible that, with a good understanding of the hazards, a spatial scope for CEA could be defined for a single sector with reasonable confidence (the SEA for oil and gas licensing has undertaken such assessment - see www.offshore-sea.org.uk**).** However, selection of the most appropriate geographical scale is more complicated if the interaction between impacts from other sectors operating over different spatial scales are also considered. Participants therefore suggested that the boundary for SEA should take account of the extent of impacts as far as possible but would also be a driven by other factors such as the distribution of the activity or the distribution of sensitive species or habitats.

7.5.3 General comments

If the focus of the assessment is a single environmental component, its' distribution would determine the spatial limits of CEA, for example a conservation feature within a protected area. However, in almost all cases CEA will be driven by a 'tool' such as EIA, SEA or Marine Spatial Planning in relation to either a project (activity or development) or plan. Any such project or plan will encompass a range of environmental components, making it difficult to define a single boundary based on such components. Therefore in practice the project or plan will set the boundary, for example:

(a) the spatial extent of potential impacts in an EIA;
(b) the distribution of a sector in a sector specific SEA, such as for the oil and gas SEA;
(c) a regional sea for Marine Spatial Planning.

7.6 Spatial resolution

Resolution is closely related to the spatial scale being considered but also to the scale at which data is available. At the relatively small scale of an EIA there is likely to be a need for data at relatively high resolution. It was agreed that data collected or collated at the SEA scale is rarely sufficient to help at the EIA scale. For larger areas, such as a regional sea level within Marine Spatial Planning, there is a trade off between using and presenting the best resolution data, and giving comprehensive coverage across the area which will usually only be possible using the lowest resolution data. For example, a 'complete' picture of the habitats across the area covered by the Irish Sea Pilot could only be achieved using broad geophysical attributes to derive landscapes rather than by building up from detailed biological information (Golding *et al* 2004).

The resolution of available data will be very variable depending on the reasons why it was originally collected. High resolution data is often spatially restricted. Conversely, existing data can be at too coarse a resolution for more site specific studies. For example, whilst existing data on seabirds is sufficient to describe broadscale distribution, data is also required at a site specific level in order to assess impacts of a specific development, such as an offshore windfarm. BMT Cordah (2003) states "These data however, were limited in their scale and temporal detail…… The lack of recent and detailed distribution data, including nearshore reaches, is considered to be a data gap".

Participants agreed it was not possible to standardise the resolution required, ie there is no single optimum. In many cases, the resolution of data on which CEA was based was limited by available data, or the resources required to collect data, rather than by what the assessment required.

7.7 Consequence - identifying and quantifying significance of effect

7.7.1 Environmental components

Valued ecosystem component (VEC) is a term that has been used to describe a generic group of habitats, species or other features of ecological interest for the purpose of focusing the scope of CEA (Oakwood 2002). Participants agreed that 'environmental component' would be a more relevant term to use in the UK. They agreed that the term is not restricted to, but does include, features of nature conservation interest. Environmental components have tended to include habitats or species but they could equally include mosaics of habitats or even sections of coast.

7.8 Sensitivity and Vulnerability

Much information already exists on the sensitivity of key UK marine species and habitats through the projects such as MarLIN (see for example Tyler-Walters, Lear and Hiscock 2003 www.marlin.ac.uk) and various reviews (for example Jones, Hiscock & Connor 2000), so limited time was spend on this area of discussion.

Delegates discussed the definition of 'sensitivity' and 'vulnerability'. It was concluded that sensitivity must include both the tolerance of the receptor to an impact (or associated hazard) and the recoverability of the receptor. Once the sensitivity of an environmental component to a particular impact has been assessed it is possible to look at the exposure of the environmental component to the impact in order to assess vulnerability. Exposure will include the duration, intensity and frequency of the impact.

Comments were made on the difficulty of taking account of sensitivity and vulnerability in CEA. Recommendations included:

- whilst it is possible to 'score' sensitivity of a particular environmental component to a particular factor, this is not practical when assessing the sum of different factors (eg smothering and disturbance), whether caused by the same activity or different activities. Instead, an assessment of the combined effect needs to be made using best judgement;
- until more is known about the consequences of activities (either alone or in combination) on the marine environment, it is likely that practitioners will need to take a pragmatic approach and accept that a strong element of judgement is required when identifying sensitivity and vulnerability.

Assessment of impacts can start either with the activity in question and the hazards associated with it, or with the environmental components likely to be affected, and their sensitivity. Participants agreed that where possible starting with the environmental component rather than the activity would be the preferred option for undertaking CEA, as done in developing advice for European marine sites (Gilliland 2001). In reality, in EIA and SEA assessment of

cumulative effects starts from the perspective of the individual development or sector. In these cases, CEA should be carried out for each environmental component (see section 7). Consideration should be given as to how the CEA for the different environmental components might be combined. It was recognised it is difficult for an individual developer or a particular sector to start from the perspective of particular environmental components. However Marine Spatial Planning would be more amenable to this approach.

7.9 Carrying capacity

The discussion focussed on environmental carrying capacity, (ie what level of impact can a particular area support), rather than economic or development carrying capacity, (for instance, how much infrastructure can be accommodated in a particular area or location). Participants found this a very difficult subject to both define and address, and to objectively identify and then quantify 'when enough is enough'. This is difficult not only when considering scenarios for one sector, such as how many windfarms should be built in the Irish Sea, but even more so when considering the full range of activities occurring or predicted to occur over a foreseeable timescale in a given area.

Some remained sceptical about the concept of carrying capacity in relation to environmental management. Experience to date indicates just how difficult it is to define thresholds. For example, it has been difficult to define 'significance' or 'adverse effect on integrity' in relation to the proportion of a habitat affected by a proposed development in assessments within European marine sites (Special Areas of Conservation and Special Protection Areas). In such cases decisions have to be made about whether predicted impacts are acceptable or not using the best available information and judgement.

The marine environment is naturally dynamic, responds to climatic variability, and our use of it is also changing. Therefore carrying capacity, however defined, will change over time. The period of time being considered is also important, as carrying capacity needs to take account of recovery periods for impacted environmental components.

To help define carrying capacity it is essential to have clear objectives. Such objectives, set within strategic goals for the marine environment driven by UK policy in the context of principles such as sustainable development, should reflect our (societal) values and therefore may need to change with changing attitudes. Objectives for different sectors, eg oil and gas, renewable energy, and nature conservation, may be compatible but they may also be in conflict. Spatial planning should co-ordinate and reconcile these sectoral objectives. The more these objectives are quantified the better.

The best prospects for defining well quantified thresholds, such as a generic benchmark of 'when does an impact matter', are probably only available for well studied species (see examples in the MarLIN programme www.marlin.ac.uk), and biotopes characterised by such species. However, our knowledge of marine species and habitats is still sparse and there are few examples where we have sufficient data to provide such thresholds. This is particularly true of mobile marine species such marine mammals or seabirds.

7.10 Taking account of human induced global change

CEA tends to focus on the impacts of specific human activities, but how do we take account of widespread or pervasive anthropogenic change such as sea level rise due to climate change? Participants agreed that it would be important to 'factor in' such global change but found it difficult to see how to do this. It was thought that such assessment is really required at a national or higher level to inform the development of a broader national Plan, beyond the scope of Marine Spatial Planning at a regional level. It was considered that predictions of the effect of climate change on coastal and sea areas, and of the difference made to such change by different scenarios of renewable energy, should be taken account of at a national level to inform the development of spatial plans.

7.11 Need for guidance

Whilst there is a growing literature on CEA (eg James *et al* 2003**)** developers and regulators were clear that they need further, specific guidance on how to undertake marine CEA. Some felt guidance was needed to give more confidence to developers and regulators on the process, outcome and decision reached. Others wanted practical guidance addressing issues such as how to acquire data. In addition, it was felt that there needed to be better application of existing guidance.

8. General discussion - the link to spatial planning

8.1 Introduction

The general discussion considered the relevance of Marine Spatial Planning to cumulative effects but also the relationship between these and SEA and EIA. Whilst the workshop was not focussed on Marine Spatial Planning in its own right, the scope and nature of which have been considered in more detail in other material (CoastNET 2003, Tyldelsey & Hunt 2004, David Tyldesley & Associates 2004), the discussion did also highlight a number of points which are briefly recorded here.

8.2 CEA and the relevance of marine spatial planning.

CEA is simply a process to assess and inform decisions about cumulative effects. EIA, SEA and Marine Spatial Planning are, therefore, relevant and potentially complementary 'tools' in undertaking CEA, addressing different elements and different scales, ie a nested approach, rather than any being ‘better’ than the other. Ideally, a spatial plan would be produced that was informed by assessment of cumulative effects and which would then provide a context for further assessment, such as that required for an individual development.

As assessment moves from the more specific scale of an EIA to the broader, regional scale of a spatial plan, the ability to predict cumulative effects becomes more complex and less certain with the data available. Participants emphasised the need to limit expectations about what marine spatial planning can achieve in assessing cumulative effects.

Whilst spatial planning will not eliminate or even reduce the uncertainty in assessing cumulative effects, it should improve our ability to make more informed decisions in relation to avoiding or managing such effects.

8.3 Marine Spatial Planning and Strategic Environmental Assessment

There was some discussion about the relationship between Marine Spatial Planning and SEA. It was considered that SEA could be a tool for integrating environmental concerns into planning but that thus far it has been used to take account of the predicted environmental impacts of a particular economic project or programme, eg to inform licensing for oil and gas activities on the UK Continental Shelf. If environmental issues are already effectively integrated into planning there might be less need for sectoral SEA or more likely, the latter could be less burdensome to undertake.

Recent experience in the UK, for example with the offshore wind industry, has demonstrated that it is a challenge to cover one industry within an SEA, and very difficult for an SEA to cover all industries and activities. Even if many sector-specific SEAs were combined into a 'super SEA', it would be insufficient because the SEA process is not required to address objectives of different sectors and therefore will not deliver a plan.

Thus, compared to SEA, Marine Spatial Planning can:

- Reconcile different and potentially conflicting objectives (between development/use and environment but also between different sectors of use)
- Undertake forward planning
- Increase certainty to developers by identifying areas where no development is likely and areas preferentially allocated to one sector, reducing (but not necessarily eliminating) the risk that the applicant will commit substantial resources to a project that may not go ahead;

Whilst combining existing SEAs would not create a Plan the information they contain would make a significant contribution towards planning. Indeed, in some areas where oil and gas SEAs have been undertaken it may be a relatively small step to build on the output of the SEA to produce the information base for a spatial plan. Furthermore, marine spatial planning is still a concept being considered and, if accepted, will take several years to develop and establish. In the meantime, SEA is already being undertaken and much could be achieved in implementing it for a number of marine sectors (see 8.5). This would also facilitate integration of such sectors into a spatial plan.

There were mixed views on how SEA would relate to a marine spatial plan once established. Clearly a plan itself would need to be subject to SEA. One the one hand, if environmental issues were properly integrated into the planning process the required assessment would be relatively limited. On the other hand, SEA of a plan may be the best means to achieve such integration. It was considered useful to seek further guidance from government including ODPM and to draw on experience from SEA and the planning system on land (ODPM 2003). Once established, a spatial plan should provide the basis to undertake further SEA of particular sectors if required and could reduce the burden on individual applicants to undertake cumulative assessment for a single development.

8.4 Marine Spatial Planning and delivering different objectives

Marine Spatial Planning should is essentially a tool to help achieve sustainable use in a planned way. Compared to SEA, this would better ensure environmental objectives were not

considered secondary. In terms of environmental objectives, it was considered that Marine Spatial Planning would be a more strategic and efficient way of expressing environmental values than is currently available to inform assessment at SEA and EIA level.

Marine Spatial Planning also provides a tool for co-ordinating/integrating many different objectives, some of them potentially conflicting. How, for example, do we accommodate projects required to meet the national target for renewable energy, the predicted need for aggregates, representative marine protected areas, and aspirations for the tourist industry? To do so requires some 'decision rules', eg 'in this region we will only achieve 70% of our target for sector X in order to accommodate 50% of the target for sector Y'. The degree to which conflicting or competing objectives are resolved within a plan will depend on how prescriptive the plan is. Marine Spatial Planning would reduce conflict but not remove it completely. In such cases, there would need to be a 'fall back' process, equivalent to the public inquiry process in the land use planning system.

8.5 The sectoral scope of spatial planning and environmental assessment

Marine Spatial Planning will not be effective unless it encompasses all sectors of development and use. The wind and aggregates industries, for example, would find it difficult to agree to decisions made within a spatial plan that affected them if other sectors such as fishing were not also encompassed. Participants were clear that it was essential to engage with all relevant marine sectors in developing Marine Spatial Planning. The corollary of this is that Marine Spatial Planning would appear to provide a better means for bringing the full range of marine sectors together than an all encompassing SEA.

Those activities that are consented or licensed are already subject to EIA, increasingly to SEA and are also the activities that are most obviously amenable to being addressed by spatial planning. However, over time other activities, such as fisheries, are likely to be subject to SEA. This is likely to occur in the next 3-5 years and therefore probably sooner than the establishment of a marine spatial planning system. Such assessments should assist the development of a spatial planning system and facilitate the integration of relevant sectors into spatial plans.

8.6 Information and Data

Regardless of scale, there are clear benefits in bringing data together to inform Marine Spatial Planning, SEAs, EIAs and specifically CEA. If we are going to produce sensible spatial plans, we need to draw on available information on cumulative effects. Until now the oil and gas SEAs have been very useful in drawing data together at the 'regional' scale envisaged to be relevant to spatial planning (www.offshore-sea.org.uk). If a spatial plan were being drafted for the Irish Sea it should draw on the information and analysis used to assess cumulative effects in the offshore wind SEA (BMT Cordah 2003).

Despite the contribution of SEAs, it is clear from work such as the Irish Sea Pilot (Lumb *et al* 2004b), that there is some way to go to collate existing data, make the best use of it, identify, and prioritise obvious remaining gaps. Participants thought a commitment to Marine Spatial Planning could drive a more strategic and comprehensive approach to managing data for the marine environment. In doing so, Marine Spatial Planning could give sufficient focus and impetus to tackle long standing issues in data gaps in a way that has not been tackled hitherto in response to assessing cumulative effects.

In the absence of a marine spatial plan, there was no clear view on who might lead a process to address data issues. However, it was felt that Defra were key given their initiatives to investigate data management under the Marine Stewardship process. It would require better working across government departments, building on the example of the Marine Consents and Environmental Unit (www.mceu.gov.uk) established between Defra and the Department for Transport.

8.7 Managing uncertainty - the potential role of 'reference' or 'insurance areas'

Participants explored the possible role of areas or zones where no activity takes place as a measure within marine spatial planning, including making decisions with respect to cumulative effects. Whilst such an idea can be considered in isolation, this was discussed within the context of Marine Spatial Planning.

Even with a good information base, there may be situations where it is difficult to judge with sufficient certainty whether a development or use is being undertaken sustainably without some kind of benchmark. There are a number of options that might be considered to help provide this. One option could be some form of 'reference' sites or zones free of direct exploitation (evidently they may not be free of indirect effects such as contaminants transported from outside of the site).

Within a marine spatial planning framework, it was suggested that such areas might also offer a measure to help to address risk and uncertainty. Whilst environmental assessment seeks to minimise risks associated with a development or use, there is often still a degree of uncertainty and predictions about impacts can turn out to be wrong. Such uncertainty increases with the cumulative effect of many developments and a range of uses.

There were a range of views on the efficacy of such areas compared to other measures. The discussion highlighted that the role of such areas, in the context of spatial planning rather simply in terms of benefits to a specific sector, should be discussed further.

8.8 The need to test Marine Spatial Planning

A lack of information, or even significant gaps in data, should not prevent progress being made on Marine Spatial Planning. To that end, all agreed that we should get on with trialling Marine Spatial Planning in some way. The discussion about Marine Spatial Planning reminded participants of the debate about how to do SEA 10 years ago where in the end it was concluded that it was best to get on and do it and learn from the experience.

However, what happens whilst Marine Spatial Planning is being developed? Developers need to be reassured that things won't change overnight. How do you pick an 'area' to trial as there is a likelihood of upsetting someone? Participants suggested that there was a lack of understanding about the limitations of Marine Spatial Planning; it will not solve everything, but instead provides a framework within which to make decisions to the benefit of developers and environmental interests without necessarily replacing current consenting regimes. Planning involves review and revision. It is important that all those involved in and affected by Marine Spatial Planning understand this and contribute to the process. It is therefore

crucial that there is more involvement of users and industry in discussing and developing Marine Spatial Planning.

9. Conclusions and Next steps

9.1 Conclusions

The following is derived from a combination of the above, conclusions put forward in the workshop and the summing up.

It is difficult to separate discussion of cumulative assessment from that of broader planning and environmental assessment. All these topics are complex and inter-linked. There is a danger that Marine Spatial Planning will be seen as a panacea or as a means for everyone to achieve their objectives, which is unlikely in practice. This is one of the reasons why the Marine Spatial Planning debate needs to move on to how it would work in practice and to better involve the full range of stakeholders. Participants felt that this was one of the first occasions that the debate about Marine Spatial Planning had moved from the conceptual to the practical, using CEA as a focus or 'test' of what Marine Spatial Planning might achieve. Not surprisingly, the workshop did not provide answers to all the questions posed and highlighted further questions. However, the following conclusions can be drawn.

9.1.1 Cumulative assessment process

- The fundamental components of a cumulative assessment process are spatial data describing the activity, and the key environmental components that are being assessed. Subsequent analysis must then define the scale and intensity of interactions between these, taking account of sensitivity and vulnerability.
- Such analysis relies on a wide range of information sources including expert judgement, meta-analysis and models, supported by Geographic Information Systems technologies and procedures.
- Despite the increasing quantity of literature on cumulative assessment, there is a clear need for better, targeted guidance on CEA for developers and regulators operating in the marine environment.

9.1.2 Scale and resolution

- Spatial scale will differ between various types of Assessment and Plan, but in principle for CEA it is mainly dependent on what is being assessed, which in turn depends upon the activity and/or environmental component.
- Although Assessments and Plans will operate over a range of different timescales, in principle the temporal boundaries for CEA are strongly related to what is being assessed.
- In almost all cases CEA will be driven by a 'tool' such as EIA, SEA or Marine Spatial Planning in relation to either a project (activity or development) or plan. Any such project or plan will encompass a range of environmental components, making it difficult to define a single boundary based on the latter. Therefore in practice the project or plan will set the boundary.

- In general, the larger the spatial scale being considered the longer the period of time that needs to be considered.
- In many cases the resolution of data, whether temporal and spatial, is limited by what data are available rather than by the limits set by the particular assessment.

9.1.3 Consequence

- It is not possible to score combined sensitivity and combined vulnerability, in relation to the response of an environmental component to a single external factor, but it is possible to rank components on a relative basis using best judgement.
- Where possible assessment of cumulative effects should start from the perspective of environmental components rather than activities. However, in practice it is difficult for individual developers or sectors to do this in EIA or SEA. It is more likely that it could be done in spatial planning. Carrying capacity is a useful concept in theory but very difficult and complicated to define and use in practice, particularly when applied to a range of environmental components and/or over the spatial scale likely to be covered by a spatial plan.
- Carrying capacity is further complicated because a variety of influencing factors, including natural change, human use and societal values, change over time.

9.1.4 Relationship between Marine Spatial Planning, SEA, EIA and CEA

- Marine Spatial Planning, SEA and EIA are complementary tools in assessing and addressing cumulative effects. None is 'better' than the other, rather it depends on the scale and what is being assessed.
- Moving from the more specific scale of an EIA to the broader, regional scale of a spatial plan, the ability to predict and therefore assess cumulative effects becomes more complex and less certain. However, spatial planning should improve the ability to manage and avoid such effects.
- Whilst recognising the benefits of sectoral SEA, Marine Spatial Planning offers additional benefits including integration of clearly articulated environmental objectives with economic and social objectives, reconciling conflict between different sectors of human activity as well as between the full range of human activities and the environment, and bringing more certainty to developers and others earlier in the decision making process. Ideally, a spatial plan would be produced, subject to SEA and this would then provide a context for any further, sectoral SEA required. In reality, Marine Spatial Planning needs to build on sectoral SEAs already undertaken. Further, Marine Spatial Planning will take several years to establish and in the meantime much could be achieved by undertaking SEA of particular sectors, such as those completed for the hydrocarbon and renewable energy sectors and those that may be undertaken for sectors such as fisheries, which would facilitate the development of a spatial planning system.
- If we are to produce sensible spatial plans, we need to draw on information on cumulative effects and other issues from a range of sources including, in particular, existing SEA.
- Regardless of scale, there are clear benefits in bringing data together to inform spatial plans, SEAs, EIAs and specifically CEA.

- More could be done to maximise the use and value of existing data Marine Spatial Planning should help bring together the data that may inform CEA.
- A commitment to Marine Spatial Planning might give better focus and impetus to tackle long standing issues such as providing clear environmental objectives at a broad scale or addressing prioritised data gaps that haven't been tackled solely in response to assessing cumulative effects.
- In the context of spatial planning, rather than management of a particular sector, there is a potential role for areas or zones where no activity takes place as some form of 'reference' and/or 'insurance', but this requires much more discussion.
- A lack of data should prevent progress being made in exploring and developing marine spatial planning through testing it in practice, learning from the experience and adapting accordingly.
- Whilst it was welcome that there were representatives from industry, we need to ensure more industry and user group participation in the debate about marine spatial planning.

9.2 Next steps

9.2.1 In relation to CEA

- Provide a collated list of published material on CEA.
- Produce further guidance on CEA (which should include link to Marine Spatial Planning).
- Discuss further and provide guidance on carrying capacity.

9.2.2 In relation to data

- Complete current government reviews of marine data management as soon as possible
- Take urgent practical steps to collate and make widely accessible marine data from a range of sources, including but not restricted to public agencies

9.2.3 In relation to Marine Spatial Planning

- Provide a collated a list of material /projects/meetings on Marine Spatial Planning
- Keep up the pressure to not only make the case for Marine Spatial Planning but also tackle implementation and how it would work in practice
- Provide further guidance and example of environmental objectives
- Undertake trial project to test and develop Marine Spatial Planning in practice at an appropriate scale, ie regional sea. We do need to reflect on a range of existing initiatives, such as the RMNC and Irish Sea Pilot, to scope such a project but the biggest limitation to making progress is resources. However, all agreed that we should pursue such a trial as soon as possible.
- As well as a trial project, progress needs to be made on general issues. However, this is intimately linked to the outcome of various on-going reviews including the *Regulatory Review of Development in Coastal and Marine Waters*.

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Annex A - Delegate list

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Annex B - Workshop agenda

The practical implementation of Marine Spatial Planning – understanding and addressing cumulative effects

4 December 2003, Hilton International, Stansted Airport.

Morning Session Chair: *Paul Gilliland*

09.45 Coffee + registration

10.00 Welcome *Robert Canning*

10.05 Introduction *Paul Gilliland*

10.15 Approaches to assessing cumulative effects
Oakwood Liverpool Bay project for CCW *Patience Dring*
Offshore wind SEA, BMT Cordah *Trevor Baker*
Building on previous approaches and MarLIN output, CEFAS *Stuart Rogers*

10.30 Discussion, including common issues and key components

11.00 Introduction to working groups *John Hamer*

11.10 Working groups
- Spatial issues
- Temporal issues
- Consequences

13.00 LUNCH (rapporteurs prepare)

Afternoon session: Chair: *Stuart Rogers*

13.30 Reporting back (10 minutes per group)

14.00 General discussion

14.30 The link to spatial planning - how can it help with decisions on cumulative effects

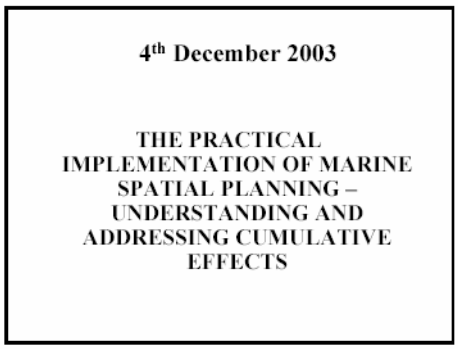
15.30 TEA

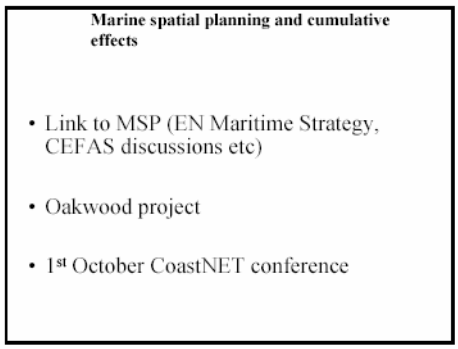
15.40 Next Steps and Conclusions

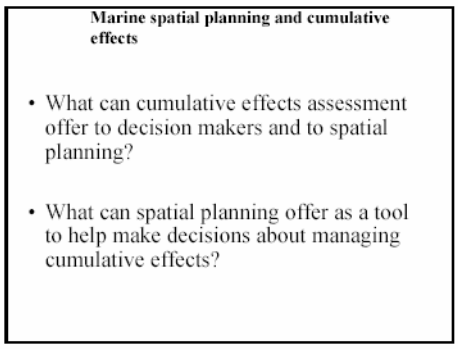
15.55 Summing Up *Robert Canning*

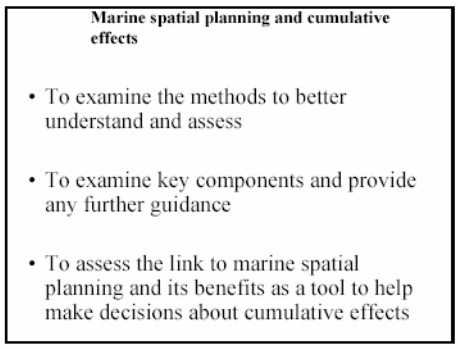
16.00 End

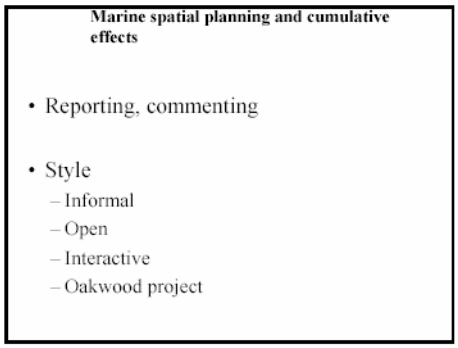
Annex C - Presentations

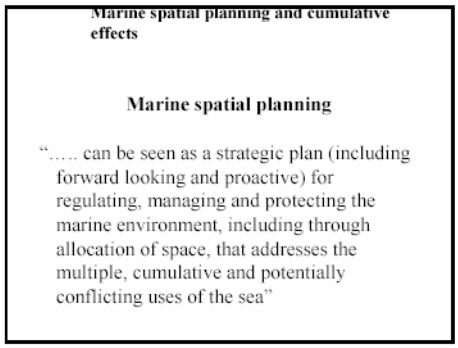












A framework for cumulative effects assessment.

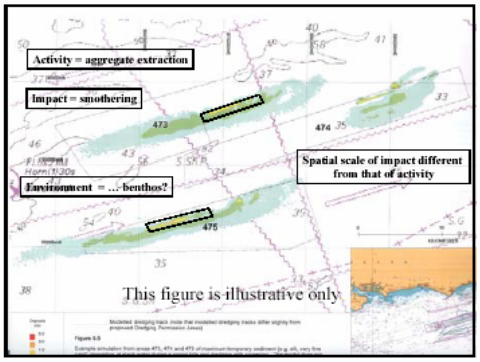
(or, the things we are going to need to do)

Stuart Rogers

CEFAS, Lowestoft Laboratory, UK

1. DECISIONS

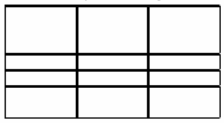
1. Define ACTIVITIES - both site specific (i.e. turbines) and widespread (i.e. fishing).
2. Define the major IMPACTS of these activities - (use well understood categories i.e. smothering, physical disturbance).
3. Define SPATIAL and TEMPORAL extent of impacts, at different intensities.
4. Agree on standard units of measure (VECs) of the ENVIRONMENT.



2. SCORING

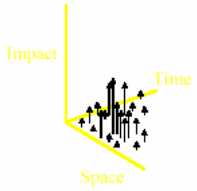
Two options.

1. Allocate scores to activities or impacts using best judgement.
2.



3. Use 2D or 3D models based on research output showing the relationship between levels of an impact, and the response of a VEC.

Illustrative 3D model showing relationship between intensity of an impact, and its' extent. This relationship will apply to a specific VEC.



3. SPATIAL ANALYSIS

1. Grid models provide the best representation of the impacts of activities, in terms of their intensity and scale. (Reducing data to a grid avoids complications with geographical boundaries of environmental or other data).
2. Must decide on the scenario (i.e. let's compare now with the future).
3. Cumulative effects will be some function (additive/ synergistic/…) of all the impacts in the scenario.

4. LINKS TO SPATIAL PLANNING

1. Once agreement has been reached on 1. DECISIONS and 2. SCORING, we can do 3. SPATIAL ANALYSIS on some impact scenarios.
2. The tool can be used for local consents studies as well as broad scale planning.
3. Cumulative effects assessment will inform decision makers about the different implications for the environment of various planning / consenting options.
4. It is a decision-*support* tool.

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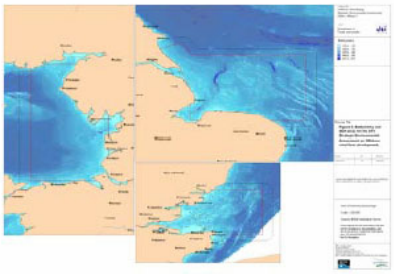
Offshore wind SEA and cumulative impacts

- Spatial and temporal boundaries
- Impact assessment
- Constraints map
- Cumulative impacts
- Cumulative impacts method and rationale

BMT Cordah Limited



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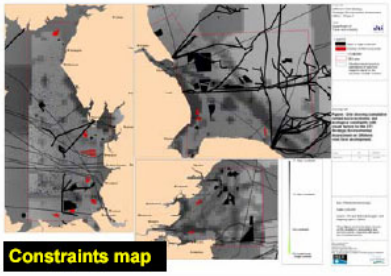

Constraints map

BMT Cordah Limited

- **Consequence:** effect of an activity's interaction with the natural and socio-economic environments
- **Likelihood:** probability that an activity will occur
- ***Risk = consequence x likelihood***

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Cumulative impacts

- Interactions between impacts of windfarms and other developments and initiatives
- Incremental, combined effects of different, specific impacts from windfarms
- Type and significance of impact will depend on: 1. scale and density of windfarms and other activities and 2. their location

BMT Cordah Limited

Qualitative (expert judgement) assessment of the main likely cumulative impacts, because:

- Distribution data gaps
- Impact understanding uncertainties
- Development cycle and technology advances uncertain

Introduction to working groups

- Number of key issues to be addressed
- Consider key questions and concepts – don't get bogged down
- Focus on:
  - Spatial issues
  - Temporal issues
  - Consequences

Scenario

- Each group has reports and information
- Irish Sea area
- Range of activities
  - Oil and gas
  - Aggregate extraction
  - Wind farms
  - Fisheries - trawling
- May be useful to consider scenario, i.e. building wind farms in area (Offshore wind SEA provides 'likely' scenario)

Scenario

- Value Ecosystem Components (VEC's)
  - Marine landscape (e.g. shallow water mud basin)
  - Fish habitat
  - Common scoter (closely linked to habitat)
  - Horse mussel beds
  - Cetaceans
  - MPA's
- What are their sensitivities to direct and indirect impacts, how do we assess these?

Spatial issues

- Q's to consider:
  - Spatial boundary
  - Resolution
  - Carrying capacity
  - Integrating with a spatial planning

Temporal issues

- Q's to consider
  - Temporal boundaries
  - Resolution
  - Carrying capacity
  - Integrating with a spatial planning

Consequences

- Q's to consider
  - Sensitivity
  - Risk and vulnerability
  - Carrying capacity
  - Integrating with spatial planning

Group work

- ~ 2hrs to address some key issues
- Chair will outline group work
- Guiding questions have been provided
- Each group report back (10 mins) after lunch
- Disciplined reporting back

The Assessment of Cumulative Effects of Marine Activities in Liverpool Bay

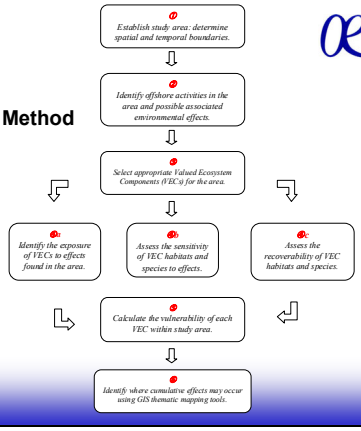


Full copies of the CEA report are available at:

www.ccw.gov.uk/reports

Understanding & Addressing Cumulative Effects
Stansted, December 2003

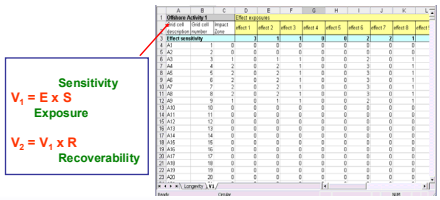
Oakwood's Method



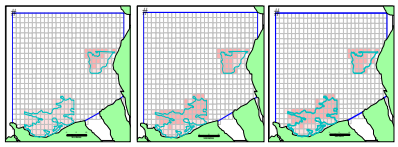
Boundaries

Spatial boundaries	Temporal boundaries
❑Natural processes ❑Past, current, and foreseeable offshore activities ❑Ecological requirements of selected environmental features ❑Project budget	❑2002 – Current status ❑2003 – Windfarm construction ❑2004 – Windfarm operation

Vulnerability Calculation



Relative vulnerability (V_2) of potential common scoter habitat / IGS Biotope to smothering effects



Current Construction Operation

High Low

Mapping Output

❑Useful to visualise the spatial extent of cumulative effects,

❑Limited by qualitative data, which require specialist descriptive interpretation,

❑Little data available on thresholds of tolerance to effects, and therefore significance of results difficult to assess.

Link to Spatial Planning

❑GIS tool provides spatial and temporal interpretation,

❑Visual output assists decision-making.

❑Specified sea use areas might aid determination of spatial area for CEA,

❑Starting point / baseline database of information on resources, VECs, activities, etc.

Annex D - Discussion Group Questions

Spatial

1. What should be the spatial boundary of the assessment? (Should it be specific to a project, to an activity, to Valued Ecosystem Components (VEC), or a regional scale?)

2. What spatial resolution should we use to assess cumulative effects? (Is there an optimum resolution? Should it be activity-specific? What are the advantages/disadvantages of the options?)

3. What do the conclusions from this discussion contribute to addressing carrying capacity of the ecosystem (ie when is enough enough?).

4. What do the conclusions from this discussion contribute to marine spatial planning? (How do the boundaries compare with the likely boundary/scale for a Spatial Plan?).

Temporal

1. What should be the temporal boundary of the assessment, ie over what period should we assess? (Should it be specific to a project, to an activity, to Valued Ecosystem Components (VEC), to a plan?).

2. What temporal resolution should we use to assess cumulative effects? (Is there an optimum resolution? Should it be activity-specific? What are the advantages/disadvantages of the options?).

3. What do the conclusions from this discussion contribute to addressing carrying capacity of the ecosystem (ie when is enough enough?).

4. What do the conclusions from this discussion contribute to marine spatial planning? (If the boundary is specific to a project/activity/VEC how does this compare with the likely period for a spatial plan?).

Presumably 1 and 2 require consideration of duration of impact(s), frequency of the impacts, recovery of VECs etc.

Consequence (Significance of effects)

1. How do we assess sensitivity, not only for individual activities/factors on particular VECs but also of multiple factors (from single or multiple activities) and of different durations? (Can or should this be quantified and if so is there an optimum approach? Can this be done/shown spatially?)

2. How do we assess risk and therefore, in conjunction with sensitivity, assess vulnerability? (Can or should this be quantified and if so is there an optimum approach? Can this be done/shown spatially?)

3. What do the conclusions from this discussion contribute to addressing carrying capacity of the ecosystem (ie when is enough enough?). (This is closely linked to

sensitivity, vulnerability and importance, for example are we able to identify limits or thresholds for VECs? Where we can't, are there are other key considerations to guide us, such as objectives which encompass values for the environment?).

4. What do the conclusions from this discussion contribute to marine spatial planning? (Does spatial planning offer a useful or the optimum tool to reflect objectives for different sectors, including the environment, and for setting the limits of development?)

Annex E - Case material to inform Discussion Groups

Spatial units

- Irish Sea Pilot area
- Offshore Wind Strategic Area – Liverpool Bay
- Oakwood cumulative effects exercise – Liverpool Bay

Range of activities and factors

- Oil and gas
- Aggregate extraction
- Wind farms
- Fisheries - trawling

For factors see 'Matrix of environmental factors and human activities' (Tyler-Walters, H., Lear, D.B. & Hiscock, K., 2003).

Valued ecosystem components

We suggest considering a limited number at different scales

- Marine landscape such as shallow-water mud basin
- Fish habitat
- Common scoter (closed linked to habitat)
- *Modiolus* mussel beds
- Cetaceans (not necessarily closely linked to habitat)
- MPAs

Scenario

It would be useful to consider a scenario against which to consider key points. We suggest that this would be the addition of a number of windfarms of the scale of the 'likely' scenario considered in the Offshore Wind SEA but this could be discussed further.

Most of the information was derived from BMT Cordah 2003, Lumb *et al* 2004b (plus material additional to that report) Oakwood 2002.

ENGLISH NATURE

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Front cover photographs:
Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: Co_2 experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
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