



**Options and Recommendations for Incorporating Socio-Economic
Activity within Network Design Tools to Assist in the Proposal of
Marine Conservation Zones: Summary Report**

Stephen Hull, ABPmer



Key Findings

- Network design tools can be used to identify alternative MCZ network options which take account of broad socio-economic criteria, minimizing the area required for ecologically compliant networks;
- The variability in network designs across the scenarios modelled in this study suggest there are wide choices in where MCZs can be located while still meeting the ecological criteria;
- The locking-in of existing and recently designated SAC areas into network design has the potential to reduce the spatial overlap with socio-economic interests outside of SAC areas by up to 40% depending on the scenario;
- The study has shown that the use of cost layers is very effective at steering site selection away from key socio-economic interests with up to a 50% reduction in spatial overlap being achieved depending on the scenario.
- No deterioration in the ecological performance of network designs was observed with increasing incorporation of socio-economic factors, clearly indicating that socio-economic factors can be taken into account without compromising achievement of the ecological criteria.

Introduction

The Crown Estate is strongly committed to the sustainable management of the marine estate and has supported the enactment of the Marine & Coastal Access Act (MCAA), including the provisions to establish Marine Conservation Zones (MCZ) as part of a coherent network of marine protected areas. The Crown Estate is fully engaged in the Regional MCZ Projects that have been tasked with taking forward the work to identify MCZ in English territorial and adjacent offshore waters.

The MCAA includes provisions to take account of social and economic consequences of MCZ designation during the site selection process. The Ministerial Statement on the Creation of a Network of Marine Protected Areas (11th March 2010) indicated that 'In ensuring we create an ecologically coherent network, the Government wants to minimise any adverse social and economic impacts and wherever possible to work with the grain of sustainable economic use of the seas.'

As part of its contribution to the MCZ designation process The Crown Estate commissioned a research study from independent marine consultants¹ to explore how minimization of socio-economic impacts might be achieved.

Background to the Importance of the MCZ Process to The Crown Estate

The Crown Estate owns virtually the entire UK seabed out to the 12 nautical mile territorial limit, in addition to the sovereign rights to explore and make use of the natural resources of the Renewable Energy Zone on the UK continental shelf, with the exception of oil, coal and gas².

¹ ABPmer, 2010. Marine Conservation Zone Network Options. Report R1683. September 2010.

² Energy Act 2004

The Crown Estate also owns around half of the foreshore, the area between mean high and mean low water (spring tides in Scotland) and approximately half of the beds of estuaries and tidal rivers in the United Kingdom.

Under The Crown Estate Act 1961 The Crown Estate has a duty, "to maintain and enhance its value of its estate and the return obtained from it, but with due regard to the requirements of good management". The Crown Estate has two key remits, the sustainable development of its assets to generate revenue for the HM Treasury and a stewardship role to conserve resources.

The Crown Estate can bring to bear a high level of knowledge and expertise on issues relating to management of the foreshore, the territorial seabed and continental shelf, and is committed to working with Government and all stakeholders on issues which affect these areas.

The Crown Estate recognises the marine environment contains some of the United Kingdom's most important areas for conservation and protection, and also requirements for development, leisure use and commercial activities. As a landowner, The Crown Estate seek to maintain the highest standards for its assets by ensuring that management of these important areas is carried out in a responsible way with all necessary statutory consents, whilst complying with its obligations under The Crown Estate Act, to derive profit from its activities. The Crown Estate also funds research aimed at better understanding the impacts of commercial activities which in turn helps it to develop more responsible management practices.

The Crown Estate supports the designation of Marine Conservation Zones (MCZs) under the Marine and Coastal Access Act 2009 as an extremely welcome development to support the future regulation and protection of the UK seas.

What were the aims of the research?

The study has sought:

1. To research the benefits of Network Design Tools for identifying potential MCZ's
2. To identify the effectiveness of Network Design Tools in meeting the Ecological Network Guidance while incorporating socio-economic factors
3. To make recommendations on benefits, limitations and assumptions in the methodology of Network Design Tool for the MCZ process

Through the study The Crown Estate has also sought to understand what the possible implications of MCZ designation might be on socio-economic activities and due to its extensive interests, have used The Crown Estate's portfolio of marine business interests as an example, including:

- Marine aggregates
- Offshore wind farms
- Wave and tidal energy
- Telecommunication and Power Cables
- Pipelines
- Gas storage
- Carbon capture and storage

- Aquaculture

The Crown Estate is using the findings from the study to inform how to engage with the regional MCZ projects and the types of information contributed. The findings also help identify the possible trade-offs that might need to be made across The Crown Estate's different business activity areas and with other stakeholder interests.

It is important to note that this study has been designed to understand the effectiveness of incorporating socio-economic considerations into Network Design Tool to meet the Ecological Network Guidance (ENG). To do this, The Crown Estate's business activity areas and other stakeholder interests have been used as examples to conduct the research. This study is not attempting to provide the solution to the designation of an ecologically coherent network. This is the responsibility of each MCZ Project Team. However the results of this study provide information to assist the Project Teams if they decide to use network design tools in the process.

How was the study taken forward?

The study has sought to develop and test a number of alternative scenarios for MCZ networks within each of the four English MCZ regions. The networks have been developed taking account of the published Ecological Network Guidance³ and using spatial data on the nature conservation features for which MCZ will be designated⁴.

The Ecological Network Guidance contains numerous criteria and a large number of different nature conservation features need to be included in the networks. For example:

- Broad-scale habitats - the network is to include approximately 15-40% of the total area of each of these habitats with a minimum of 2 areas within each MCZ region. The minimum diameter of these areas should be 5km with an average diameter of 10-20km;
- Habitat features of conservation importance (FOCI) - the network is to include a minimum of 3 discrete areas for each habitat FOCI which must be of a minimum size (which varies depending on the particular habitat); and
- Species features of conservation importance (FOCI) - the network is to include a minimum of 3 discrete patches for each species FOCI which must be of a minimum size (which varies depending on the particular species).

To simplify the process of designing networks, an MPA network design tool – Marxa – was used to create networks that as far as possible meet the necessary ecological criteria for each feature. This tool has been used to support MPA network design in many other countries and provides an efficient way of meeting multiple criteria that can be used to minimize the overall size of the networks.

As well as taking account of ecological criteria, Marxa can also incorporate socio-economic interests. Firstly, it is possible to lock-in or lock-out specific planning units within the network design process. This can be used to preferentially select areas of low socio-

³ JNCC & Natural England, 2010. Marine Conservation Zones Project. Ecological Network Guidance. June 2010.

⁴ Broad-scale habitat data was obtained from UKSeaMap and habitat and species FOCI data from the Defra-led MPA Datalayers project (MB0102)

economic interest or to avoid areas of high interest. Secondly, it is also possible to apply weighted cost layers to steer site selection away from areas of high socio-economic interest.

Spatial data on key socio-economic interests was obtained from The Crown Estate's Marine Resource System (MaRS), supplemented with some additional socio-economic data layers prepared to support MPA planning⁵. A total of 38 socio-economic data layers were used in the analysis, taken from current lease areas and future opportunities for The Crown Estate seabed assets: including:

- Marine aggregates
- Oil & gas installations and pipelines
- Offshore wind farms (OWF)
- Wave and tidal areas
- Telecommunication and power cables
- Gas storage areas
- Carbon capture and storage areas
- Navigation dredging and disposal areas
- Commercial fishing areas; and
- Aquaculture installations.

Where available, information on potential future interest areas was also taken into account. These are areas that The Crown Estate deems to be technically suitable for the deployment of offshore renewable energy, for aggregate extraction or for CCS/Gas storage.

To explore the scope for steering network selection away from areas of socio-economic importance, the study applied a number of scenarios incorporating socio-economic factors in different ways and to different degrees:

- Scenario 1 – pure ecological network (the scenario creates an ecological network based on the Ecological Network Guidance criteria alone, without any consideration of socio-economic constraints)
- Scenario 2 – ecological network with existing Special Areas of Conservation (SACs) locked-in to site selection (the scenario creates an ecological network which conforms to the Ecological Network Guidance criteria but which locks in existing SACs into network design)
- Scenario 3 – low weight cost layer to steer site selection away from socio-economic interests (the scenario creates an ecological network which conforms to the Ecological Network Guidance criteria but where site selection is steered away from areas of high socio-economic interest)
- Scenario 4 – as scenario 3 but with existing Special Areas of Conservation locked-in to site selection (the scenario creates an ecological network which conforms to the Ecological Network Guidance criteria but which locks in existing SACs into network design and, in areas outside of SACs, steers site selection away from areas of high socio-economic interest)
- Scenario 5 – high weight cost layer to steer site selection away from socio-economic interests (the scenario creates an ecological network which conforms to the Ecological Network Guidance criteria but where site selection is strongly steered away from areas of high socio-economic interest)

⁵ CEFAS & ABPmer, 2010. Socio-economic Datalayers to Support MPA Planning. Defra project MB0106

- Scenario 6 – as scenario 5 but with existing Special Areas of Conservation locked-in to site selection (the scenario creates an ecological network which conforms to the Ecological Network Guidance criteria but which locks in existing SACs into network design and, in areas outside of SACs, strongly steers site selection away from areas of high socio-economic interest)
- Scenario 7 – as scenario 6 but with existing marine aggregate licensed areas and application areas and R1/R2/R2.5 and R3 OWF locked-out of site selection (the scenario creates an ecological network which conforms to the Ecological Network Guidance criteria but which locks in existing SACs into network design, locks out existing marine aggregate licensed areas and application areas and R1/R2/R2.5 and R3 OWF sites (in areas outside of SACs) and, for other interests in areas outside of SACs, strongly steers site selection away from areas of high socio-economic interest)

The networks produced by Marxan for each of these scenarios within each MCZ region were then analysed to assess their performance against key ecological criteria and the extent of spatial overlap with socio-economic interests.

What are the limitations of the study?

The Marxan tool is helpful in being able to rapidly generate plausible network solutions from large amounts of data. However, such analyses are subject to the limitations of the available data, limitations of the Marxan tool in coding the ecological criteria and the simplifying assumptions that necessarily have to be made. Furthermore, the study represents only an initial attempt to explore how socio-economic criteria might be incorporated into network design. The network solutions developed should therefore be seen as illustrative and do not represent firm proposals for the location of MCZs.

The study has used the best data available at the time. However, it is recognised that the available data layers are not comprehensive (additional data is being collated through the Regional Projects). At the time of the study, no intertidal data layer was available and this has not been included in the analysis. The broad-scale habitat data is also going through a process of refinement, particularly to take account of better information on the distribution of subtidal rock.

Not all of the ecological criteria could be coded within Marxan, for example, no assessment of performance has been made in relation to the following criteria: overall diversity, important areas for key life cycle stages of species, high natural pelagic productivity or the requirement to identify reference areas (where extractive and bed-disturbing activities are likely to be prohibited).

The factors and weightings included in the cost layers have been based on the judgments of the study team. The use of different factors and weights would lead to different outcomes for network design. The cost layers have sought to take account of the major economic interests and particularly those sectors for which measures are more likely to be required (e.g. extractive and bed disturbing activities).

The study assumes that the extent of spatial overlap between socio-economic interests and the MCZ networks provides a reasonable indication of the potential relative costs of management measures that industry may incur to support achievement of conservation

objectives for the MCZ. While, based on previous research⁶, this assumption is likely to be valid at a broad level, the actual costs incurred will depend on the form of the conservation objectives for each site and decisions on the need for specific management measures. Furthermore, the study assumes that the cost of management measures may be reduced where MCZ are co-located with existing SACs on the basis that the measures required to support the achievement of SAC objectives will - in some cases - also help to achieve MCZ objectives, therefore keeping overall costs lower. While this is likely to be applicable where MCZ and SAC objectives are similar, it may not apply to MCZ reference areas, for which the conservation objectives are likely to preclude all extractive and bed-disturbing activities.

What did the results show?

The scenarios produced widely varying network designs both in terms of location of sites and overall network size, occupying between 15-42% of each search area (Figure 1, Table 1). On the basis that the potential costs of management measures are likely to be proportional to overall network size, smaller networks might be preferred in terms of reducing socio-economic costs.

Table 1. Variation in Network Size

	Search Area km ²	Modelled scenarios network size (Range) km ²	% of area (range)	First iteration network size km ² (%)
Net Gain	112,303	19,746-30,576	18-27	-
Balanced Seas	18,708	2,764-4,275	15-23	3,446 (18)
Finding Sanctuary	94,872	15,129-17,636	16-19	39,804 (42)
Irish Sea	17,408	2,687-5,958	15-34	2,773 (16)

The modelled scenarios should be seen as illustrative, as a large amount of further development would be required to develop specific proposals for sites. For example, sites may need to be adjusted to maximise performance against ecological criteria and to take account of additional supporting ecological factors. It may also be necessary to regularise the shape of individual sites for management purposes, although this is not an ecological requirement and the regularization process runs the risk of both reducing ecological conformance and/or significantly increasing socio-economic costs.

Overall, the modelled scenarios performed well against the ecological criteria for which they were assessed, fully meeting the percentage area and minimum number requirements for broad-scale habitats and largely meeting the minimum number requirements for habitat and species FOCI. Because it was not possible to encode the requirements for minimum diameter of feature patches within Marxan, the networks performed less well against this criterion, although compliance was still reasonable. In a number of instances, the habitat or species FOCI patches within a region were either too few and/or too small to meet the minimum number or minimum diameter requirements of the ENG.

While the limitations of the Marxan tool compromised, to some extent, full achievement of the ecological criteria, it would be possible to address these shortcomings in further

⁶ ABPmer, RPA & Jan Brooke, 2007. Cost Impact of Marine Biodiversity Policies on Business - The Marine Bill. CR0378: Natural Environment Group Science Division.

iterations of network design by locking in specific areas containing features that were essential to network compliance.

Importantly, no deterioration in the ecological performance of network designs was observed with increasing incorporation of socio-economic factors, clearly indicating that socio-economic factors can be taken into account without compromising achievement of the ecological criteria.

The scenarios demonstrated significant variation in the extent of spatial overlap with socio-economic interests (Table 2 provides a summary for the Net Gain area), including activities within TCE's business areas. None of the scenarios tested in any of the Regions were able to completely avoid socio-economic interests, suggesting that some level of overlap is inevitable if the ecological criteria are to be met.

Scenarios which locked out licensed marine aggregate areas and application areas, and offshore wind farm areas outside of existing/recently designated SACs were able to largely avoid overlap with these interests outside of SAC areas while still meeting the ecological criteria.

Table 2. Summary of Spatial Overlap for Net Gain Region Scenarios

Scenario	Network Area (Km ²)	No of Sites	Overlap With Socio-Economic Interests - Area (km ²) ¹	Overlap With Socio-Economic Interests Outside SAC - Area (km ²) ¹
1. Pure ecological network	30576	42	53632	47511
2. Pure ecological network with SACs locked in	20527	41	48307	28153
3. As 1 but with low cost avoidance	19657	44	25436	Not assessed
4. As 2 but with low cost avoidance	19746	73	46141	25987
5. As 1 but with high cost avoidance	20701	43	52779	Not assessed
6. As 2 but with high cost avoidance	18659	73	35875	15722
7. As 6 but with aggregate and wind farm areas locked out	19544	58	39225	19072

¹ For activities represented by polygon data - e.g. aggregates sites, aggregate application areas, offshore wind farms, dredge material disposal sites, gas storage sites, hydrocarbon fields, shellfishing areas etc. The total area of overlap exceeds the total area of the network, because activities can overlap, for example, the potential future use areas for marine aggregates and offshore wind overlap with existing uses and with each other.

The scenarios clearly demonstrate the scope for steering site selection away from areas of high socio-economic interest within each Region, including The Crown Estate interests (see Figure 2). Across the study, the use of cost layers reduced total overlap with socio-economic interests by between 10 to 50% depending on region and scenario.

The study also identified that the locking in of existing and recently designated SACs significantly reduces the extent of overlap between MCZ networks and socio-economic interests outside of SACs by up to 40%. This could potentially be an important mechanism for minimizing costs, particularly in areas where SAC and MCZ objectives are likely to be similar. For MCZ reference areas, more stringent conservation objectives are likely to be established. It is currently unclear whether the illustrative networks might meet the requirements for reference areas while also minimizing potential socio-economic costs nor whether locking in SACs into the network helps or hinders in minimizing these potential costs.

The locking out of existing marine aggregate licence areas and application areas and offshore windfarm areas was successful in reducing the extent of spatial overlap for these activities outside of SACs. However, in several of the scenarios this resulted in an overall increase in spatial overlap with socio-economic interests suggesting that such reductions are achieved at the cost of other sectors and result in an overall less efficient solution from a socio-economic perspective.

The findings from this study suggest that the use of cost layers to steer site selection away from key socio-economic interests is **very** effective at minimising spatial overlap. Furthermore, the cost layers can be used to deliver relatively equitable outcomes across the different socio-economic interests.

What are the key conclusions?

The Marxan tool can be used to identify alternative MCZ network options which take account of broad socio-economic criteria. The tool is able to minimize the area required for ecologically compliant networks. This will contribute to minimising socio-economic costs in its own right as these costs are likely to be proportional to network size. The variability in network designs across the scenarios suggests there are wide choices in where MCZ can be located while still meeting the ecological criteria.

All of the modelled scenarios in this study largely met the ecological criteria for which they were assessed and to the extent possible, although further refinement of the networks would be required to develop firm proposals for sites.

The locking-in of existing and recently designated SAC areas within the MCZ network has the potential to reduce the spatial overlap with socio-economic interests outside of SAC areas by up to 40% depending on MCZ Region. The locking-in of SACs into the Regional networks could therefore provide a potentially important way of reducing socio-economic costs, particularly where SAC and MCZ objectives are comparable. It is currently unclear what the

implications of locking in SACs may be in terms of minimizing the potential costs of management measures within MCZ reference areas.

The scenarios demonstrate that it is possible to steer site selection away from areas of socio-economic interest without any obvious reduction in performance against the ecological network criteria assessed, with around a 10 to 50% reduction in total spatial overlap between the network and socio-economic interests across English MCZ Regions. None of the scenarios were able to completely avoid overlap with socio-economic interests suggesting that some level of overlap is inevitable if the ecological criteria are to be met. The locking out of key marine aggregate and offshore wind farm interests reduced spatial overlap for these activities but at the expense of other socio-economic sectors. The resulting network solutions also tended to be less efficient in terms of total spatial overlap compared to some of the other scenarios.

In this study, the combination of locking in SACs and using cost layers to steer site selection away from socio-economic interests was able to reduce the overlap between the MCZ network and socio-economic interests by up to between 23 and 67% in areas outside of SACs compared to a pure ecological network scenario and depending on Region.

To deliver balanced outcomes for different socio-economic interests the approach adopted by the Regional Projects would benefit from the use of cost layers as this appears to be able to identify relatively equitable solutions.

The study has highlighted the importance of trade-offs between different socio-economic interests and not just between those interests and nature conservation. The *a priori* locking out of some socio-economic interests in preference to others is likely to be difficult to justify in policy terms, although it is clear that some interests have stronger policy support and contribute more to the economy than others. In these circumstances the use of differential weightings to reflect policy priorities or economic contribution may be appropriate. Such approaches may also be helpful in defining the trade-offs that need to be made and thus facilitate the negotiation of acceptable solutions.

Where can I get more information on the study?

The study report is available for downloading from <http://www.thecrownestate.co.uk/marine>

Alternatively the main report and any further information can be obtained from Olivia Burgess: Olivia.Burgess@thecrownestate.co.uk