Annex H7 Method for assessing impacts on commercial fisheries

Contents

1 Summary of technical methods for commercial fisheries

H7.1 This annex summarises the method used in the Impact Assessment (IA) to assess the impact of the recommended Marine Conservation Zones (rMCZs) on commercial fisheries.

1.1 Baseline description

H7.2 The baseline describes current commercial fishing activity in the areas covered by the suite of rMCZs. It describes fisheries at a national, regional and local (within the area covered by rMCZs) level, and includes value of landings estimates. In Annex I, for each rMCZ, value of landings estimates by gear type are only provided for gear types potentially affected by the rMCZ. The baseline draws on information provided by stakeholders and the MCZ Fisheries Model (discussed below). In the absence of information about how fisheries will change over the next 20 years, the description is provided for current fisheries, taking account of any known (or likely) significant recent trends where possible.

1.2 Management scenarios

H7.3 Management scenarios have been developed for each rMCZ; these make assumptions about the potential management of commercial fishing that may be needed to achieve the conservation objectives of the features protected in each rMCZ. Scenarios have been used to enable assessment of the potential costs of rMCZs to the commercial fishing sector in the IA.

H7.4 Where there is considerable uncertainty about the management that may be needed for an rMCZ, more than one scenario has been used to represent the range of potential management. For an individual rMCZ, this may include scenarios ranging from ‘no additional management’ to ‘full closure of an MCZ’, in order to ensure that the full potential range is considered. It should be noted that, for rMCZs with conservation objectives of ‘recover’, some form of management is anticipated. However because it has not been possible to establish the lower end of the management range in such situations, a default ‘no management scenario’ has been included.

H7.5 The scenarios are for illustrative purposes only and do not constitute recommendations. After designation, the management of activities in rMCZs will be decided upon on a case-by-case and site-by-site basis, and may differ from the management scenarios in the IA.

H7.6 The scenarios have been established by the regional MCZ projects, drawing on information and advice provided by the regional MCZ project vulnerability assessments, regional steering group recommendations, the Joint Nature Conservation Committee (JNCC), Natural England and public authorities.

H7.7 Some of the additional fisheries management that JNCC and Natural England have advised should be considered in the IA did not become apparent until October 2011. This was after discussions had been completed with stakeholders about fisheries management and its impacts. As a result, material for the IA includes scenarios for fisheries management that stakeholders were not previously aware of.

1.3 Estimating the impact

H7.8 Information on the impact of the rMCZ management scenarios on commercial fisheries was derived from two sources. First, a quantitative estimate was made of the impact on the

economy arising from the effect of the management scenarios on fisheries. This estimate was made on the basis of the value of landings affected and the resulting impact on gross value added (GVA). The value of landings affected was derived using a model (the MCZ Fisheries Model) that employed datasets which describe the value of landings and the distribution of fishing effort. Secondly, a qualitative assessment of the economic and social impacts of rMCZ management scenarios on fisheries was carried out, based on consultation with representatives of the fishing industry.

1.4 Estimates of the value of landings affected

H7.9 For areas where closure to a gear type is suggested as a management scenario, the IA assumes that the entire value of landings would be lost for that gear type in the affected area. Where a reduction in pressure from a gear type is suggested for an area, it is assumed that half of the value of landings would be lost for that gear type in that area. These assumptions have been made in the absence of more detailed information on the effect of the management scenarios on fisheries.

H7.10 The impacts are assessed relative to the baseline.[1] The MCZ Fisheries Model provides estimates of the value of landings taken from each rMCZ by the UK fleet, based on best available data. It has not been possible to provide micro-scale forecasts, and so the model assumes that the spatial distribution and the value of landings will remain constant over the IA's 20-year timeframe.

H7.11 The MCZ Fisheries Model provides geographic information system (GIS) data layers that describe the spatial distribution of landings, by value, for different types of fishing gear. The model can be queried to produce estimates for the value of landings for a given gear type that are attributed to any given area. The model was constructed using the following data inputs:

- Marine Management Organisation (MMO) iFISH data (at the request of Defra) provided information on the value of landings by vessel, gear type and International Council for the Exploration of the Sea (ICES) rectangle.
- Processed Vessel Monitoring System (VMS) data provided an estimate of the spatial distribution of fishing effort, by gear type, for vessels of over 15 metres.
- FisherMap data provided an estimate of the spatial distribution of fishing effort, by gear type, for vessels of less than 15 metres.

H7.12 The impact on UK GVA was estimated based on the value of landings affected for the UK fleet and using economic data collected by Seafish economic surveys.

H7.13 For non-UK fleets (including the fleets of other EU member states), estimates of the value of landings have been included on the basis of information provided directly by national fiseries bodies in those countries. The Marine Management Organisation (MMO) formally requested information from the relevant authorities in other countries, but no new information was provided in response. Some information was acquired in the course of international engagement undertaken by JNCC on behalf of the regional MCZ projects.

[1] The baseline describes commercial fishing activity in the situation where no MCZs are designated.

1.5 Qualitative description of fisheries and impacts

H7.14 The qualitative assessment of the anticipated economic and social impacts on fisheries of the rMCZ management scenarios is based on information collected from a selection of UK fishers, representatives of the UK fishing sector, regulators and representatives of the national fisheries bodies of other countries. The UK stakeholders who were invited to engage in this process were identified by the regional MCZ projects from their databases of fishers, representatives and regulators that had been involved in the work of the regional MCZ projects. The individuals were selected to provide coverage of the range of gear types and geographic locations affected by rMCZs. Additional individuals who could advise on likely impacts and were identified during the survey process were also invited to provide input. Information from representatives of national fisheries bodies of other countries was collected by the JNCC on behalf of the regional MCZ projects in the course of its engagement with these bodies.

H7.15 Information was gathered on how fishers might respond to the management that might be needed for rMCZs, including:

- displacement of effort;
- gear adaptation and changing gear type;
- changing target species;
- vessels leaving the local fleet; and
- impacts on upstream and downstream businesses.

H7.16 The rest of this annex provides a more detailed description of the method used to assess the impacts of rMCZs on the UK commercial fishing sector.[2] The method is presented under the following sections: section 2 – baseline description; section 3 – management scenarios; section 4 – quantitative assessment of the economic impact of rMCZs on UK fisheries; section 5 – qualitative assessment of the economic and social impacts of rMCZs on UK fisheries; section 6 – assessment of impacts on non-UK commercial fishing.

2 Baseline description

H7.17 Baseline descriptions are provided at each of the spatial scales at which the impact assessment is reported: individual rMCZ (provided in Annex I), regional MCZ project area (presented in Annex L) and MCZ project area (in the Evidence Base document for the IA). Impacts that are attributed to sub-regional groups of sites are presented in Annex J.

H7.18 The baseline describes fisheries in the absence of rMCZs. The descriptions provide a summary of the fisheries that may be affected at each spatial scale (rMCZ, regional project area or MCZ project area). This includes the value of landings of the affected fisheries, and the total value of landings of all fisheries present. In Annex I, for the area of each rMCZ, baseline information by gear type is provided only for those gear types that may be affected by rMCZs (as defined by the management scenarios). Unless specified otherwise, the estimates of the value of landings for the UK fleet are based on information provided by the MCZ Fisheries Model (described below). The

[2] This does not include commercial aquaculture operations, which are considered separately, see Annex H Approach for assessing impacts on aquaculture.

qualitative descriptions also draw on information that has been provided by the regional stakeholder group (RSG), MMO, Inshore Fisheries and Conservation Authorities (IFCAs), representatives of fishers' organisations and individual fishers, as specified in the text.

H7.19 Information on the prevailing trends in commercial fisheries is discussed at the UK level in Annex D. However, information was not available at a sufficient level of detail to make quantitative forecasts of the value of landings for the spatial units used in the MCZ Fisheries Model (see later section 'Data sources and technical specifications of the MCZ Fisheries Model'). The estimated annual value of landings used in the baseline descriptions has, therefore, been held constant over the IA timeline, unless otherwise stated. This may result in overestimates and/or underestimates of future values of landings.

H7.20 Due to a number of uncertainties, no adjustments have been made to the spatial distribution of landings in order to account for the impacts of marine Special Areas of Conservation (SACs) that are yet to be designated. Uncertainties include: (i) the type of management that will be implemented, including the extent to which access may be granted to parts of an SAC to vessels using inshore VMS; (ii) the impact of displaced fishing effort from the SAC on the value of landings in the surrounding area.

3 Management scenarios

H7.21 Management scenarios were developed for each rMCZ. They make assumptions about the potential management of commercial fishing that may be needed to achieve the conservation objectives for features protected by the rMCZs. The management scenarios indicate additional management, over and above any existing fisheries management, that may be required to achieve MCZ features' conservation objectives.

H7.22 The scenarios are for illustrative purposes only and do not constitute recommendations. After MCZ designation, the management of fisheries required for MCZs will be decided upon on a case-by-case and site-by-site basis, and may differ from the management scenarios used in this IA. The management that is adopted will be informed by additional evidence on the location, the sensitivity and the existing condition of features protected by MCZs, and on the level of pressure (if any) exerted on the features. Consideration will also be given to the consequences of displacement arising as a result of MCZs, other protected areas and other activities in the marine environment. Where there is considerable uncertainty about the management that will be required, additional investigations may be needed. The costs of this are considered in the section of the IA on 'Monitoring'.

H7.23 The management scenarios have been established by the regional MCZ project teams, drawing on information and advice provided via the regional MCZ project vulnerability assessments, by JNCC and Natural England on fisheries management for the purposes of the IA (further details are provided in Appendix 1 of this Annex) and information from other formal and informal meetings and conversations with JNCC, Natural England and public authorities. Where there is considerable uncertainty about the management that may be needed for an rMCZ, more than one scenario has been used to represent the range of potential management. For an individual rMCZ, this may include scenarios ranging from 'no additional management' to 'full closure of an MCZ' for specified gear types, in order to ensure that the full range is considered.

H7.24 In addition, where regional stakeholder groups (RSGs) provided specific management recommendations for an rMCZ, these have been included as one of the management scenarios for that site. RSG management recommendations describe the restrictions that the RSG believed are required to enable the conservation objectives of an rMCZ to be met.

H7.25 Where additional fisheries management is not expected to be required a scenario of 'no additional management' is identified. This term recognises that other non-MCZ-related fisheries management may take place in the rMCZ.

H7.26 Some of the additional fisheries management that JNCC and Natural England have advised should be considered in the IA did not become apparent until October 2011. This was after completion of the regional MCZ project discussions with stakeholders about management scenarios for the sites, and after the regional MCZ project economists had finished discussing the implications of potential fisheries management with stakeholders. As a result, material in the IA includes scenarios for fisheries management that stakeholders were not previously aware of. This additional fisheries management information has been included because the IA needs to present the advice from JNCC and Natural England on the range of management that may be needed to mitigate the impacts of fisheries on MCZ features.

H7.27 The scenarios for fisheries management that are presented in the IA draw on the following:

- Advice on fisheries management supplied by JNCC and Natural England for the purposes of the IA (see Appendix 1). Application of the advice was a desk-based exercise undertaken by Balanced Seas, Net Gain, and Irish Sea Conservation Zones (ISCZ). Further details on the assumptions employed in applying the advice are provided below and in Appendix 1. **Unless specified otherwise, scenarios are based on this advice**.

- Prior to the receipt of this later advice from JNCC and Natural England (see Appendix 1) on fisheries management scenarios, Finding Sanctuary had developed scenarios based on the outcomes of the Finding Sanctuary vulnerability assessment, JNCC and Natural England advice on the impacts of fisheries on MCZ features (JNCC & Natural England, 2011), and the direct advice of JNCC and Natural England experts in discussions with the Finding Sanctuary project team. This exercise identified the management scenarios that were likely to be needed for each rMCZ. These existing management scenarios were added to alternative management scenarios suggested by application of JNCC and Natural England's advice which was provided later. The difference in the Finding Sanctuary approach reflects regional variation in the MCZ planning processes, with the Finding Sanctuary vulnerability assessment going further than those of other regional MCZ projects in an effort to provide stakeholders with an indication of likely management in MCZs. Outcomes from the vulnerability assessment provided site-specific management scenarios, which is why they have been augmented with the more generic advice received later, rather than discarded. The vulnerability assessment of the other regional MCZ projects did not provide any management scenarios.

- Recommended and suggested scenarios that came from the following sources: the RSG; (including 'hub' meetings in the Net Gain project area); discussions between the regional MCZ project team, JNCC and Natural England; and the regional MCZ project team's interpretation of the regional MCZ project vulnerability assessment.

H7.28 Regardless of the number of management scenarios identified for any individual rMCZ, the impacts of only two scenarios for each rMCZ are summarised in the IA Evidence Base and Summary. These are the lowest-cost and the highest-cost scenarios identified for each rMCZ. It has not been possible to establish a 'most likely' scenario. Given these two scenarios, a 'best estimate' of the cost has been established based on the relative likelihood of either of the two scenarios occurring.

H7.29 The source of the scenarios employed for each rMCZ is specified in Annex I for rMCZs in the Balanced Seas, ISCZ and Net Gain project areas and in Appendix 3 of this annex for rMCZs in the Finding Sanctuary project area.

H7.30 Charts that specify any zones (i.e. areas that do not correspond to rMCZ boundaries) that have been used in the management scenarios for rMCZs are included in Appendix 2.

H7.31 Assumptions that have been used when formulating the management scenarios are:

a. Where additional management is likely to be required of certain types of bottom trawls and dredges, the management scenario is assumed to apply to all types of bottom trawls and dredges. This is because insufficient data, evidence and advice were available to establish more refined scenarios for these gear types.

b. It is assumed that, for areas in rMCZs where non-UK vessels are active, management of fishing activity will be implemented via the Common Fisheries Policy (CFP). Non-UK vessels are permitted to fish anywhere outside 12 nautical miles (nm), and in areas between 6nm and 12nm where they have historic fishing rights. Current management options via CFP are limited to permitting or not permitting fishing in a certain area using a specific gear type at particular times. Direct management that provides other levels of restriction on fishing effort is not possible via CFP (JNCC, pers. comm., 2011, based on European Commission, 2007).

c. Where JNCC and Natural England advice indicates that pressure from commercial fishing using a specific gear type should be reduced (but not necessarily to zero), it is assumed that fishing effort using that gear type – and therefore the value of landings – will be reduced by 50% in that area. This is an arbitrary figure, used in the absence of further detail on the level of restrictions on fisheries that might be required and on how fishers might respond. Such a reduction in pressure might be achieved through a number of means, including restrictions on the use of more damaging gears and on certain size classes of vessels, but the means that will be adopted are not yet known. This assumption has only been applied to rMCZs that are not likely to be subject to management via CFP. This is because reductions in pressure other than not permitting fishing would not be feasible under the CFP (see (b) above).

d. Some level of additional fisheries management is anticipated for rMCZs that include features with conservation objectives of 'recover' where commercial fishing activity occurs. However, because it has not been possible to establish the lower end of the management range in such situations, a default 'no management scenario' has been included (even though this is unlikely to be adopted).

e. Where it seems appropriate to suggest that fisheries management might be zoned for an rMCZ, zoned management has been included as one of the scenarios. Zoned management assumes that the management required for a particular feature is only applied to the area within

the rMCZ that is covered by that feature. The management zone is, therefore, wholly situated within the rMCZ. A zone is suggested where additional management of certain gears is required for features that cover only a discrete area of an rMCZ. For the purposes of the IA, estimates of zones were made by the regional MCZ project economists on the basis of the location of features. If zoned management was to be introduced for an MCZ, it is anticipated that appropriate guidelines would be employed to demarcate the zones. Consequently, the boundaries for any zones that are implemented are likely to differ from those employed for the purposes of the IA. Zoned management has not been suggested in the following circumstances:

- for the additional management suggested for a feature that is scattered throughout an rMCZ;
- if different additional management is suggested for a number of overlapping features that occupy significant areas of the site, as this would create complex overlapping zones that would be difficult to enforce.

f. Where zoned management is suggested as a scenario, an additional scenario of uniform management is also employed. This is in recognition that it may not be practical to enforce zoned the fisheries management in an rMCZ.[3] Uniform management assumes that, for a given gear type, the most stringent management that is suggested for that gear type for any feature protected by an rMCZ applies to the entire rMCZ. However, a uniform management scenario has not been employed for large sites where zoned management applies to only a small proportion of the site. This is because it is unlikely that in such cases uniform management would be implemented in practice.

g. Where advice indicates that levels of pressure from commercial fishing might need to be limited to current levels, the IA assumes that no management will be put in place. No impacts are assumed to arise in this situation. This builds on advice provided by the MMO (pers. comm., 2011) and some IFCAs (pers. comm., 2011) that management of commercial fishing should generally not be implemented unless it is required. However, it assumes that there will be no significant increase in pressure from a fishery in the rMCZ in future (to a level at which management is required). This is based on the assumption employed in the IA that, in the absence of rMCZs, the value of landings in rMCZs will remain constant over time (see section ‘Data sources and technical specifications of the MCZ Fisheries Model’).

h. Where advice did not indicate that additional management would be required, the IA assumes that there will be no additional management.

i. If advice indicated that additional management would be needed for a certain fishing gear, but there is no evidence that that gear is used in a site, it is assumed that additional management for that gear will not be needed in that site.

j. For the purposes of the IA, it is generally assumed that no additional management is required for features with a conservation objective of ‘maintain at favourable condition’. The IA assumes that if the regional MCZ project vulnerability assessment indicates that a feature is already in ‘favourable condition’, the effects of existing levels of commercial fishing on the feature do not need to be managed. n the event that pressures from fisheries increase in future and impact on the conservation of features with a conservation objective of ‘maintain at favourable

[3] It may be difficult for enforcement officers to differentiate between vessels fishing in open areas and those fishing in closed areas in MCZs with zoned management and such management may not, therefore, be implemented.

condition', additional management of these fisheries may be required. However, this cannot be anticipated with the data available at this stage. In some specific cases, because of the high sensitivity of features, outputs from the vulnerability assessment did indicate that management may be required, despite a conservation objective of 'maintain at favourable condition', and this informs one of the management scenarios for relevant rMCZs.

H7.32 As a result of these assumptions, the assessment of impacts of rMCZs on the commercial fishing sector is subject to the following limitations:

- The actual management of commercial fishing activity put in place after designation may differ from that set out in the management scenarios; this may result in different impacts from those described in this material for the IA.
- No allowance has been made for potential changes to rMCZ management that may be needed as a result of any redistribution of effort resulting from the management of other rMCZs, other changes in fisheries management that are not related to rMCZs, or other changes in fisheries. If further management is needed to address the impacts of such changes, the resulting impacts may differ from those described in this IA.
- The range of management scenarios used for any particular rMCZ and gear type is large. It has not been possible to obtain advice on the most likely management scenario. In many instances, the upper or lower cost estimates for the range of management may significantly overestimate or underestimate the true cost after designation.

4 Quantitative assessment of the impact of rMCZs on the UK commercial fishing sector

H7.33 The quantitative assessment of the impact of rMCZs on UK vessels sets out:

- The value of landings affected. This is defined as the value of landings taken from the marine area over which rMCZ management will be imposed, and is calculated using the MCZ Fisheries Model. Where stakeholders provided alternative estimates for values of landings, these have been included in material for the IA, alongside outputs from the MCZ Fisheries Model
- The economic impact. This is defined as the contribution to GVA that would be lost as a result of the loss in landings, and is calculated based on the ratio of GVA to the value of landings.
- A 'best estimate' of the value of landings and GVA affected. This is based on the based on the relative likelihood of either the lowest- or the highest-cost management scenarios occurring, and is presented in the IA Evidence Base and Summary and Annex N. These figures are not provided at site level.

H7.34 The remainder of this section details the methodology used to derive estimates of the impact on the value of landings and GVA.

4.1 Value of UK vessel landings affected

H7.35 The estimates of the value of landings affected by the management scenarios are made on the basis of the following assumptions. The assumptions apply either to a specific zone within an rMCZ or to the entire area of the rMCZ:

- Where the management scenario identifies that an area should be closed to a particular gear type, it is assumed that all fishing effort by the gear type that is subject to the closure will cease and that the entire value of landings made from that area will be reduced to zero.

- Where the management scenario identifies that the level of pressure created by a fishing gear should be reduced, it is assumed that the level of fishing effort will be reduced by 50%, and that the value of landings by the fishing gear from that area will also fall by 50%.

- It is assumed that the value of landings from a given area is constant over time and is the same as that estimated for the baseline (see section 'Data sources and technical specifications of the MCZ Fisheries Model').

H7.36 Best estimates of the value of landings affected have been calculated based on the relative likelihood of the highest-cost and lowest-cost management scenarios occurring. In the absence of better information, it is assumed that each of the two scenarios has an equal probability of occurring, and the best estimate is therefore taken to be the mid-point of the two.

H7.37 An exception to this occurs where management scenarios were identified as a result of the advice received from JNCC and Natural England in October 2011 (JNCC & Natural England, 2011), but use of these gears had not been identified in the regional project vulnerability assessments as the primary cause of features being in unfavourable condition. In such instances it is assumed that the degree of additional management required will be less than for bottom trawls and dredges (where applicable), and is likely to be towards the lower end of the range. The best estimate is therefore calculated by applying probabilities of 0.75 to the low-cost scenario and 0.25 to the high-cost scenario.

H7.38 The limitations introduced by these assumptions include:

- In practice, the value of landings **affected** by rMCZ management will not necessarily correlate with the value of landings that may be **lost** to a fishing vessel. This is because a fisher may respond to rMCZ management by fishing elsewhere, switching gear type or reducing fishing effort by more than that directly affected by the rMCZ. However, sufficient information was not available to incoporate these factors into the quantitative analysis. Thus, the estimate of the value of landings affected may significantly overestimate or underestimate the true impact of an rMCZ on a vessel's revenue, and it does not include any estimate of the impact on the vessel's costs. While information was collected on fishers' anticipated responses to rMCZs (see section 5), in most instances, because of the inherent uncertainty in fishers' responses to rMCZs, the information was insufficient to provide a more detailed quantitative assessment of the impact on the value of landings or fishing costs.

- Management scenarios that result in an arbitrary estimate of a 50% reduction in pressure from a fishery within an rMCZ may result in an overestimate or underestimate of the value of landings affected.

- Estimates of the value of landings affected each year by an rMCZ over the 20-year timeframe of the Impact Assessment may be underestimated or overestimated as a result of the assumption that landings are constant over space and time.

- The 'best estimate' may underestimate or overestimate the true value of landings affected.

4.2 The MCZ Fisheries Model

H7.39 An MCZ Fisheries Model was created that generates estimates of the value of landings taken from each rMCZ by the UK fleet between 2007 and 2010. The model provides information on the spatial distribution of the value of landings by broad-scale gear type (see Table 1 for broad-scale gear types). The broad-scale gear types used were considered to be an appropriate level at which to discuss potential impacts to the UK fleet, and were in-line with the only existing processed VMS data available to the regional MCZ projects during the conception of the model.

H7.40 The MCZ Fisheries Model distributes the value of landings attributed to a particular ICES Rectangle, using data on the spatial distribution of fishing effort. The data inputs for the model were sourced as follows:[4]

- MMO iFISH data provided comprehensive information on the value of landings by vessel, gear type, landings port, species and ICES Rectangle[5] in which landings were caught. The IA employs data for the period 2007 to 2010. iFISH is the UK data repository for fishing vessel activity. Further information is provided in the section 'Data sources and technical specifications of the MCZ Fisheries Model'. This dataset was used on the advice of Defra as it provides an officially audited source of information. As such it was preferred to any value of landings information collected via FisherMap.

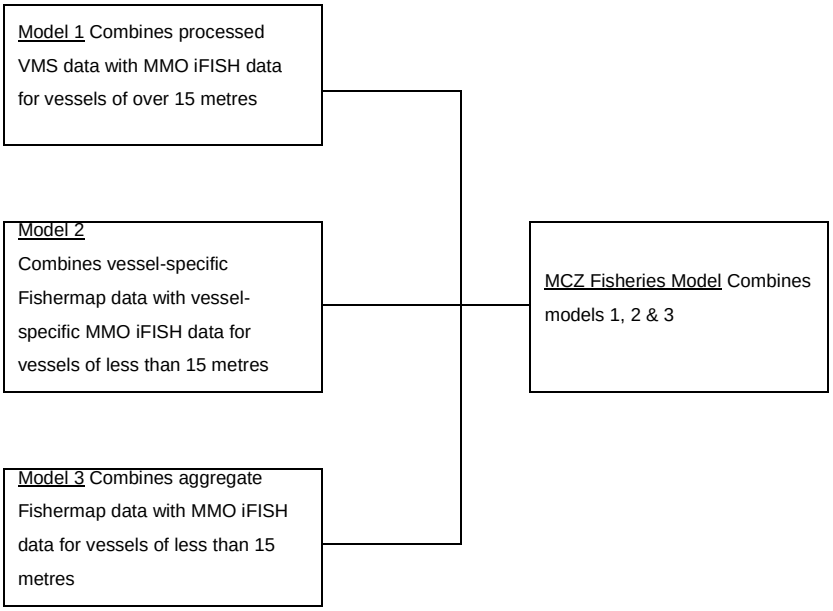
- Processed VMS data provided an estimate of the spatial distribution of fishing effort by gear type, for vessels over 15 metres. Processed VMS data use a number of parameters, one of which is vessel speed, to identify when a boat is fishing. The data were processed by the MMO using the methods developed by the Centre for Environment, Fisheries and Aquaculture (Cefas) (Lee, South & Jennings, 2010). VMS data identify the movements of fishing vessels over 15 metres in length, and are collected by the MMO at a spatial resolution of 0.05 degrees longitude by 0.05 degrees latitude (approximately 3km by 5.5km) (henceforth referred to as 'VMS squares'). Further information is provided in the section 'Data sources and technical specifications of the MCZ Fisheries Model'.

- FisherMap data provided an estimate of the spatial distribution of fishing effort, by gear type, for vessels of less than 15 metres. FisherMap[6] was a survey of fishers – conducted by the regional MCZ projects – that obtained information on where fishers fish, what they fish for, with what gear and at what time of year. The FisherMap data cover the distribution of fishing effort over the period between 2004 and 2010.

H7.41 Within the MCZ Fisheries Model there are three underlying models that calculate value layers. Each model calculates a value layer for a different group of vessels, using a different combination of the three datasets mentioned above. An overview of the model is provided in Figure 1.

[4] Further information on the data sources and their limitations can be found below, in the section 'Data sources and technical specifications of the MCZ Fisheries Model'.
[5] An ICES Rectangle is an area defined by the International Council for the Exploration of the Sea (ICES) for the purposes of statistical reporting. An ICES Rectangle measures one degree latitude by half a degree longitude.
[6] A FisherMap report detailing the methods used and key outputs is not yet available.

Figure 1 The MCZ Fisheries Model



Model 1: Value layers created for UK vessels of more than 15 metres

H7.42 For UK vessels of more than 15 metres, the spatial distribution of their fishing effort within any given ICES Rectangle was described for each category of gear type by the VMS data of each vessel (the gear type was defined using the International Standard Statistical Classification of Fishing Gear (ISSCFG), which is provided in Table 1 later in this document). The spatial distribution of fishing effort was combined with information from the MMO iFISH database on each vessel's value of landings for each category of gear. The analysis was conducted at the level of individual vessels, combining the iFISH and the VMS data for each individual vessel, in order to create vessel-specific and gear-specific value layers. These layers were then combined to provide aggregated value layers for all vessels for each broad-scale gear type (see Table 1 for a list of gears included in each broad-scale gear type). In order to protect the confidential data on each vessel used in the model, this analysis was undertaken by the MMO on behalf of the regional projects. The MMO provided the regional MCZ projects with aggregate value layers by gear type; data layers on individual vessels was not passed on to the regional MCZ projects. Further information on the data used is provided below, in the section on 'Data sources and technical specifications of the MCZ Fisheries Model'. The value layers provide data at the spatial scale of VMS squares – 0.05 degrees by 0.05 degrees. A simplified graphical example is shown in Figure 2.

H7.43 Assumptions made in the value layer for UK vessels of more than 15 metres include:

- The distribution of the value of landings within an ICES Rectangle for a given vessel of over 15 metres using a specific ISSCFG gear type, can be described by the distribution of its VMS data.

- It is assumed that the number of hours fishing can be used as an adequate proxy for fishing effort. This assumption is necessary because processed VMS data provide information on the number of hours fishing. (A vessels is classed as 'fishing' when moving at a speed greater than 1 knot but less than or equal to 6 knots).

- Within an ICES Rectangle, the value of landings associated with 1 hour of fishing for an individual vessel using a specific gear type is uniform across the rectangle.

Figure 2 Graphical representation of Model 1

Hours fishing in each VMS square of ICES Rectangle Z by vessel X, using gear Y

	A	B	C	D	E
1	36	30	20		
2	8	20	4	2	
3		16	2		
4					
5				32	30

Landings by vessel X using gear Y from ICES Rectangle Z

=> £50,000 **=>**

Value of landings in each VMS square of ICES Rectangle Z by vessel X using gear Y (£000s)

	A	B	C	D	E
1	9	7.5	5		
2	2	5	1	0.5	
3		4	0.5		
4					
5				8	7.5

Model 2: Value layers created for vessels of less than 15 metres, skipper interviewed for FisherMap

H7.44 For vessels of less than 15 metres with skippers who were interviewed for FisherMap, the spatial distribution of their fishing activity within any given ICES Rectangle is described in FisherMap, based on the fishing grounds targeted by the vessel. Fishing grounds are discrete spatial areas that fishers interviewed for FisherMap drew to show where they fish. Information on the value of landings for each vessel, by ISSCFG category of gear type (specified in Table 1), was taken from the MMO iFISH database and combined with the FisherMap data on the spatial distribution of fishing activity for that vessel. The value layer produced by the model was analysed at a spatial scale of 1km by 1km. For further details on the data, see the section below on ‘Data sources and technical specifications of the MCZ Fisheries Model’.

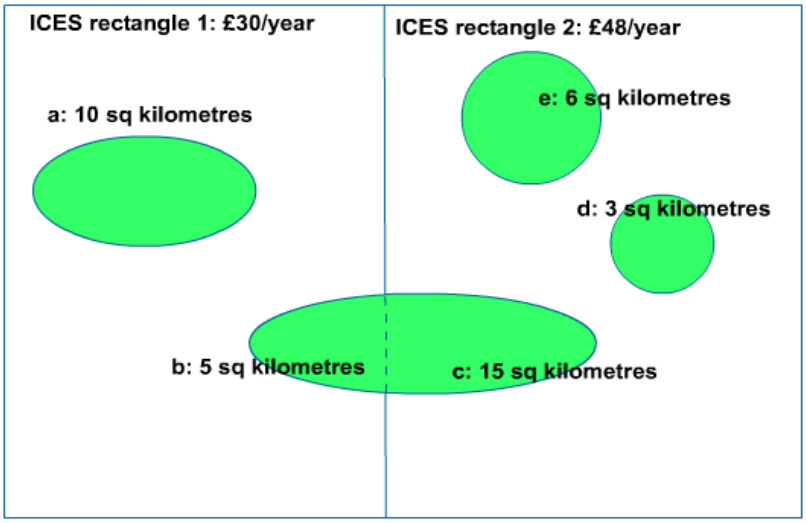
H7.45 Assumptions include:

- Spatial distribution of fishing grounds is an adequate proxy for spatial distribution of the value of landings.
- The value of landings from a given fishing ground is assumed to be evenly distributed within that fishing ground.
- Where a fisher had not indicated how a vessel’s value of landings was distributed between the fishing grounds, it was assumed that, within any given ICES Rectangle, the distribution of the fisher’s value of landings between the fishing grounds was in proportion to the size of the fishing grounds. The example below (Figure 3) describes how this was done.

H7.46 In the example illustrated below, four fishing grounds (shown in green) were identified for a single vessel through the FisherMap survey. The fishing grounds extend over two ICES Rectangles. The average annual values of landings for the vessel of £30,000 and £48,000 were identified from the iFISH database for ICES Rectangles 1 and 2, respectively. Grounds a and b

combined cover 15km^2 of ICES Rectangle 1. The value of landings from Ground a (which has an area of 10km^2) is estimated to be: (10/15) x £30,000/year = £20,000/year.

Figure 3 Graphical representation of model 2 (value of landings ('000s) from a number of fishing grounds)



Model 3: Value layers created for vessels of less than 15 metres, skipper not interviewed for FisherMap

H7.47 For each vessel of less than 15 metres in length with a skipper who was not interviewed for FisherMap, the spatial distribution of the vessel's fishing activity (its value of landings) within any given ICES Rectangle was described by aggregated FisherMap data for the relevant broad-scale gear type. The value of landings data for each vessel, by broad-scale gear type, was taken from the MMO iFISH database. In other words, the spatial distribution of fishing activity by that vessel was assumed to be the same as the distribution for all vessels deploying that broad-scale gear that were surveyed for FisherMap. The value layers from the MCZ Fisheries Model were analysed at a spatial scale of 1km by 1km.

H7.48 Assumptions include:

- The value of landings for vessels with skippers who were not interviewed for FisherMap is sourced from the MMO iFISH database at the level of ICES Rectangles.
- The distribution of the value of landings within an ICES Rectangle for a given vessel, using a given gear type, can be described by the aggregate distribution of fishing effort for the sample of the fleet which (a) uses that gear type and (b) provided information to FisherMap.
- Spatial distribution of fishing grounds is an adequate proxy for spatial distribution of the value of landings. The value of landings from a given fishing ground is assumed to be evenly distributed within that fishing ground (see Model 2).

H7.49 The steps undertaken in creating the model were:

- **Step 1:** The distribution of the value of landings for each broad-scale gear type across each ICES Rectangle was estimated using the spatial value of landings data layers created in

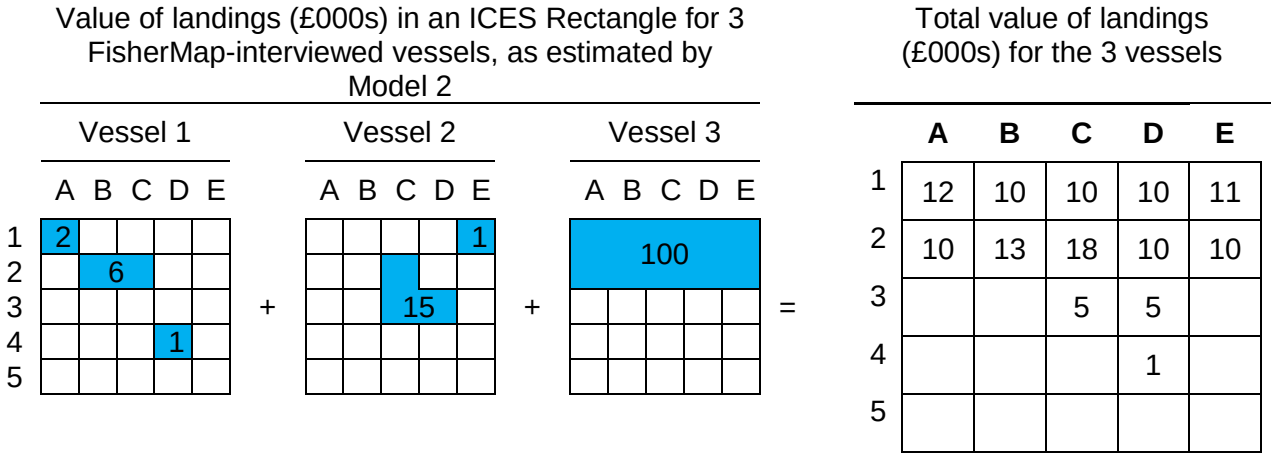
Model 2. A grid of 1km by 1km was placed over the spatial value of landings data layer created for each vessel in Model 2. For each grid square, the values of landings for all vessels using each broad-scale gear type were added together to give a total value of landings for all vessels for each broad-scale gear type for each square. The values of landings for each grid square in an ICES Rectangle were summed and converted into percentages, so that within each ICES Rectangle they totalled 100%. This provided a layer that described, for those vessels interviewed for FisherMap, the proportion of the value of landings taken from an ICES Rectangle that should be attributed to each grid square.

- **Step 2:** For each vessel with a skipper who was not interviewed for FisherMap, the value of its landings from an ICES Rectangle was distributed across the grid squares using the spatial data layer for the broad-scale gear type that the landings were caught with i.e. employing the relative proportions estimated in Step 1.

H7.50 Figure 4 below describes the first part of Step 1. In the example, FisherMap had collected information through three interviews that described the activity of 3 vessels using a particular gear type within an ICES Rectangle.

Figure 4 Graphic representation of Model 3 (Step 1 only)

Step 1: For a given gear type, add together the value of landings for each FisherMap square.



4.3 Data sources and technical specifications of the MCZ Fisheries Model

H7.51 This section includes a discussion on the following aspects of the MCZ Fisheries Model:

- value of landings data;
- distribution of fishing effort derived from processed VMS data;
- FisherMap distribution of effort data;
- gear classification;
- spatial scale of analysis;
- future values of landings;
- confidence levels;

- regional variations; and
- additional value of landings estimates.

Value of landings data

H7.52 Value of landings data were taken from the MMO iFISH database,[7] which was provided to the regional projects by the MMO with conditions of data confidentiality.

H7.53 The MMO iFISH database was used because:

- it provides official audited values of landings by the commercial fishing sector;
- the values in the database are provided by ICES Rectangle (where the fish were caught), gear type used and length of vessel; and
- it includes all commercial landings by UK vessels to both UK and non-UK ports.

H7.54 iFISH data are sourced from sales notes, which under the registered buyers and sellers (RBS) scheme must be submitted to local MMO offices for all first sales of fish . Logbook information for vessels of over 10 metres is also collected by the MMO. Further details of the methodology employed in the collection of the iFISH data can be found in MMO (2010). MMO states that it aims to achieve full coverage of activity by vessels of 10 metres or over, but that landings by vessels of less than 10 metres in length may be underreported, as fish that are not sold are not necessarily reported (MMO, 2010). The limitations of the data and of their use in the MCZ Fisheries Model include:

- Landings of less than 25kg sold direct from a fishing vessel to individuals for private consumption may not be included in the iFISH database, as there is no requirement for such sales to be reported via the RBS scheme (MMO, pers. comm., 2011). All other commercial sales will be captured via the RBS scheme.
- The data cover a short period (2007 to 2010, inclusive) and so do not fully reflect the considerable variability in landings and prices. Data on value of landings before 2007 have not been used because reliable data on value of landings are not available. Before the introduction of the RBS scheme, landings – particularly by vessels of less than 10 metres – were thought to be underreported. The RBS scheme was introduced in September 2005 and was considered to be working well by 2007 (MMO, pers. comm., 2010).
- Insufficient information is available to make credible forecasts of how future values of landings will differ from averages in recent years.

Distribution of fishing effort derived from processed VMS data

H7.55 VMS data for broad-scale categories of gear types were processed by the MMO, using a method developed by Cefas (Lee, 2010; Lee, South & Jennings, 2010) to derive the spatial distribution of fishing effort. Processed VMS data have been used for the following reasons:

[7] The iFISH database records landings into UK ports by UK and non-UK vessels and into non-UK ports by UK vessels. The database is held by the MMO. As the database does not include landings from the UK exclusive economic zone into non-UK ports by non-UK vessels, it is not a good source for non-UK value of landings data.

- European Commission legislation requires fishing vessels over a certain size to transmit their location at regular time intervals via VMS. Since 2005, this has included all vessels over 15 metres; and since 2006, transmission of speed and course data has been mandatory. VMS data provide the most comprehensive source available to derive spatial distribution of commercial fishing effort for vessels of over 15 metres.

- The data provided are considered to be the best available spatial data to use to derive distribution of fishing effort for vessels of over 15 metres (resolution 0.05 degrees longitude by 0.05 degrees latitude).

H7.56 The MMO extracted positional report VMS data from the vessel monitoring data stored in the MMO's monitoring, control and surveillance system (MCSS). These data contain the Registry of Shipping and Seamen (RSS) codes and a highly accurate positional report from VMS that is supplied approximately every 2 hours. Analysis of these position reports indicates vessel speed. Based on the assumption that a vessel is fishing when it is moving at a speed greater than 1 knot but less than or equal to 6 knots, the data were used to discriminate between position reports received when a vessel was fishing and when it was not. The RSS number was used by the MMO to identify the individual fishing vessel. Reported fishing activity data submitted for the vessel (stored in iFISH) were used to identify the gear type that was being used at the time. Further details of the methodology employed in the collection and processing of the VMS data can be found in Lee, South & Jennings (2010). The VMS data layers were not provided to the regional MCZ projects. The MMO undertook Model 1 of the MCZ Fisheries Model (as described previously) and provided the regional MCZ projects with aggregated data layers showing the distribution of the value of landings by broad-gear type.

H7.57 The limitations of the data and of their use in the MCZ Fisheries Model include:

- The processing of VMS data makes assumptions about when a vessel is fishing, based on vessel speed. This assumption may result in erroneous inclusion or exclusion of data, particularly for non-towed gear types. For static gears, the processing of VMS data based on vessel speed may not provide a reliable estimate of fishing effort. Fishing effort is more appropriately defined by the amount of gear shot and the time it is left in the water (soak time).

- The data used cover a short period (2007 to 2010) and so do not fully reflect the considerable annual variability in the distribution of fishing activity.

FisherMap distribution of effort data

H7.58 FisherMap was a survey of UK fishers undertaken by the regional MCZ projects during 2009 and 2010[8]. The purpose was to capture information direct from fishers on where they fish (their fishing grounds), what they fish for, with what gear and at what time of year. Fishers were asked to describe the pattern of their activities over the previous 5 years. The FisherMap data therefore describe the grounds fished over the period 2004 to 2010. FisherMap data were used for the IA because:

- the data provide the most comprehensive source available of the spatial distribution of commercial fishing effort for UK vessels of under 15 metres; and

[8] A FisherMap report detailing the methods used and key outputs is not yet available

- they are provided at a high resolution.

H7.59 The survey was undertaken by a team of regional MCZ project liaison officers, who visited ports and harbours around England and surveyed individual skippers. The team aimed to capture information from at least 50% of vessels of under 15 metres based at each port. Information was gathered from fishers using a survey questionnaire and charts. Fishing grounds were drawn on the charts, and these were digitised for use in the MCZ Fisheries Model. Participants were able to specify the extent to which their data could be used, within the outputs of the Fishermap survey, and for future MCZ and non-MCZ related work.

H7.60 The limitations of the data and of their use in the MCZ Fisheries Model include the following:

- As a sample of fishers was surveyed for FisherMap, the information from it represents the activity of a sample of active vessels. Overall, 28%, 47%, 72% and 20% of UK vessels under 15 metres that were active in the Finding Sanctuary, Balanced Seas, Net Gain and Irish Sea Conservation Zones project areas, respectively, were surveyed. While the samples were randomly selected, successful surveys were only carried out with fishers who were willing to participate.
- The data presents the information that was supplied by fishers. Beyond verification of aggregated FisherMap data layer outputs, it has not been possible to verify the data provided by fishers.
- The quality of the information collected depended on the ability of the interviewee to accurately draw the fishing grounds used. This information cannot easily be verified.
- In Model 2 of the MCZ Fisheries Model, the value of landings from a given fishing ground is assumed to be evenly distributed within that fishing ground.
- Where an interviewed fisher had not indicated how a vessel's value of landings was distributed between the fishing grounds within any given ICES Rectangle, it was assumed that, within that ICES Rectangle, the distribution of the fisher's value of landings between the fishing grounds was in proportion to the size of the fishing grounds.
- The data that were collected cover a relatively short period (2004 to 2010) and so do not fully reflect the considerable annual variability in the distribution of the value of landings within ICES Rectangles.

Gear classification

H7.61 The MCZ Fisheries Model uses the International Standard Statistical Classification of Fish Gear (FAO, 2002), and the analysis was carried out at this level of gear classification. The outputs from the MCZ Fisheries Model are reported at the level of broad-scale gear type, unless otherwise stated. The MMO iFISH data were reported using the ISSCFG gear classification. The VMS data were supplied for broad-scale gear types. FisherMap data used another classification of gears (shown in Table 1). Table 1 (below) shows the fine-scale gear types covered by each broad-scale gear type and how the FisherMap gear classification relates to the ISSCFG classification. The limitations of the classification system and its use in the MCZ Fisheries Model include:

- The gear classification of FisherMap was retrospectively linked to the ISSCFG in order to match up FisherMap data and MMO iFISH data. In some instances the gear types included in the two classifications are not exact matches and this is likely to have reduced the accuracy of the MCZ Fisheries Model outputs for vessels of less than 15 metres.

- All records of the gear type 'otter trawls (not specified)' are assumed to be for otter trawls with bottom contact, following the practice established by Cefas (Lee, 2010).[9] This may have resulted in some 'mid-water otter trawl' records being erroneously classified as 'bottom otter trawl' records.

- Through provision of processed VMS data for broad-scale gear types addressed issues concerning the confidentiality of data and enabled timely supply of the data, it resulted in a much lower level of accuracy than if the data had been supplied at the scale of ISSCFG categories.

[9] An analysis carried out by Finding Sanctuary of the species characteristically landed by vessels in south-west England using this gear supports this decision. The analysis estimated that over 90% of species landed by unspecified otter trawl were species typically considered to be demersal.

Table 1 Gear classifications employed in data inputs to the MCZ Fisheries Model

Broad-scale gear type	FAO International Standard Statistical Classification of Fishing Gear	FisherMap gear category
Bottom trawls (includes some seines)	Otter trawls (OTB)	Bottom trawls
	Otter twin trawls (OTT)	Bottom trawls – twin rigs
	Otter trawls (not specified) (OT)	Bottom trawls
	Other trawls (not specified) (TX)	Bottom trawls
	Pair trawls (PTB)	Bottom pair trawls
	Nephrops trawls (TBN)	Bottom trawls – nephrops target species
	Beam trawls (TBB)	Beam trawls
	Shrimp trawls (TBS)	Bottom trawls – shrimp target species
	Trawls (not specified) (TB)	Bottom trawls
	Danish seines (SDN)	Danish seine
	Scottish seines (SSC)	Scottish seine
	Pair seines (SPR)	Pair seine
Dredges	Boat dredges (DRB)	Towed dredges
	Mechanised dredges (HMD)	Power/suction/unspecified dredges
	Hand dredges (DRH)	Hand dredging
Lines	Hand lines & pole lines (hand-operated) (LHP)	Hand lines (incl. gurdy), rod and line
	Hand lines & pole lines (mechanised) (LHM)	Hand lines (incl. gurdy)
	Hooks and lines (not specified) (LX)	Lines
	Trolling lines (LTL)	Trolling
	Drifting long lines (LLD)	Drift long lines
	Long lines (not specified) (LL)	Long lines
	Set long lines (LLS)	Static long lines
Nets	Set gill nets (anchored) (GNS)	Nets – gill net
	Trammel nets (GTR)	Nets – gill net – trammel
	Driftnets (GND)	Nets – drift net
	Encircling gill nets (GNC)	Nets – gill net
	Fyke nets (FYK)	Nets – fixed net – hoop net or fyke net
	Fixed gill nets (on stakes) (GNF)	Nets – fixed net – stake net
	Gill nets and entangling nets (not specified) (GEN)	Nets
	Gill nets (not specified) (GN)	Nets
	Lift nets (not specified) (LN)	Nets
	Trammel nets (GTR)	Gill nets – trammel
	Combined gill nets-trammel nets (GTN)	Gill nets
Mid-water trawls (includes some seines)	Otter trawls (OTM)	Mid-water trawls
	Pair trawls (PTM)	Mid-water pair trawls
	Shrimp trawls (TMS)	Mid-water trawls – shrimp target species
	Mid-water trawls (not specified) (TM)	Mid-water trawls
	With purse lines (purse seines) (PS)	Purse seine
	Without purse lines (lampara) (LA)	Ring net
All pots and traps	Traps (not specified) (FIX)	Traps
	Pots (FPO)	Pots
Collection by hand	Miscellaneous gear (MIS) (includes hand & landing nets and gathering by hand)	Hand collection and hand pushed nets

Note: Only gear types for which landings were recorded in the MMO iFISH database between 2007 and 2010 have been included.

Spatial scale of analysis

H7.62 The MCZ Fisheries Model produces value layers at two spatial scales. For vessels of over 15 metres, the value layer provides data at a resolution of 0.05 degrees longitude by 0.05 degrees latitude (approximately 5km by 3.5km) grid squares, while for vessels of under 15 metres the value layer provides data at a resolution of 1km by 1km grid squares. The differences in the spatial scale of the grids is a result of the resolution of the underlying spatial distribution of effort data provided by processed VMS data (for vessels over 15 metres) and FisherMap (for vessels under 15 metres).

H7.63 In the absence of more refined effort data, it is assumed that the value of landings is evenly distributed within an MCZ Fisheries Model grid square (see previous paragraph). The edges of rMCZ shapes typically do not align with the edges of the MCZ Fisheries Model grids. Thus rMCZ boundaries may intersect a number of grid squares. To provide an estimate that is as accurate as possible with the available data, the value attributed to a dissected grid square is attributed to the rMCZ based on the proportion of the area of the grid square that is inside the rMCZ boundary. For example, if an rMCZ is situated entirely within one grid square, and covers 50% of the grid square, then 50% of the value of landings attributed to that grid square will be attributed to the rMCZ. This assumes that the value of landings is evenly distributed over the grid square.

Future rMCZ values of landings

H7.64 The MCZ Fisheries Model provides an estimate of the value of landings taken from a given area that is based on average value of landings data for 2007 to 2010, modelled distribution of effort data for vessels of over 15 metres for 2007 to 2010, and modelled distribution of effort data for vessels under 15 metres for 2004 to 2010. While trends are discussed at the national level in Annex D, the high number of variables that affect commercial fishing intensity, spatial distribution of effort, catch rates and prices means that robust forecasting of the value of landings affected by individual rMCZs was not feasible. These variables include unpredictable factors, such as the weather, the spatial distribution of fish and changes in supply and demand.

H7.65 Values of landings are therefore assumed to be constant over time and are estimated based on the above data on recent distribution of effort and value of landings. The average value of landings per year estimated for each rMCZ, based on the rMCZ Fisheries Model, is assumed to be the same in each year of the 20 years covered by the IA. In reality, it is likely that the value of landings in each rMCZ would fluctuate over time in the absence of MCZs, and so the value of landings estimates used in the IA may underestimate or overestimate the true future value of landings.

Confidence levels

H7.66 Confidence levels have been provided for the following aspects of the model outputs: Model 1 – vessels over 15 metres; and Models 2 and 3 (combined) – vessels under 15 metres. For vessels under 15 metres, the assessment of confidence is carried out at the regional scale. These are estimated using the levels of confidence that are employed in the IA, which are described in Annex H1.

H7.67 All three models utilise the MMO iFISH landings database. Since the introduction of the RBS scheme, this dataset is considered to have a 'high level of confidence'. Further discussion of the strengths and limitations of the database are set out under 'value of landings data' at the beginning of section 4.3.

Model 1: Vessels over 15 metres

H7.68 Because there is a high level of confidence in the data on value of landings from the MMO iFISH database (see above), the level of confidence of the regional model outputs for over 15 metre vessels is determined by the ability to match landings data with VMS data. The match between satellite position reports from VMS and fishing activity reports is not exact. For example, only approximately 50% of those satellite position reports estimated as representing the time when a vessel was fishing can be matched to dates when fishing activity was reported within a particular ICES Rectangle. Over 2007-2010, the average proportion of activity covered by vessels over 15 metres that supplied both activity and satellite data (the 'potential coverage') was 85% (see Table 2). This is the potential best coverage of overall activity that can be achieved by linking activity and satellite data. The average actual coverage over 2007-2010 was 62% (see Table 2). This is the proportion of total landings where an exact match has been made between the activity and satellite data within the modelling process (MMO, pers. comm., 2011).

Table 2 Potential and average proportion of total landings covered by valid VMS records

Year	Potential	Average
2007	84%	61%
2008	84%	58%
2009	86%	66%
2010	86%	65%
2007-10	85%	62%

Source: MMO (pers. comm., 2011).

H7.69 Coverage varies between rectangles; those more distant from shore show increased potential and actual coverage (MMO, pers. comm., 2011). The problems in matching data arise for a variety of reasons. There can be errors in the reporting of activity data; historically, this information has been reported in paper logbooks, giving scope for error in the recording of details (such as the reported ICES Rectangle for landings). With regards to the satellite data, the speed limits used to determine whether or not a position report relates to fishing activity are generic and are applied to all vessels and for all fishing gears in all areas, whereas differences may occur. The VMS data were processed to cover 'fishing' activity by extracting the data for vessels travelling at between 1 and 6 knots. This will produce a fairly valid picture of fishing effort for mobile gears; however, the deployment of static gear (such as pots and nets) may not be well represented (MMO, pers. comm., 2011). Further limitations in the raw data and the method used to process the VMS data are described in Lee (2010) and Lee, South & Jennings (2010).

H7.70 Given the actual coverage figure of 62%, it is considered that at least 'medium confidence' can be ascribed to the model outputs for vessels of over 15 metres.

Models 2 and 3: Vessels under 15 metres

H7.71 All regional models use the MMO iFISH database for value of landings inputs. Because there is a high level of confidence in the data on value of landings from the MMO iFISH database

(see above), the level of confidence of the regional model outputs for under 15 metre vessels is determined by the FisherMap data on distribution of effort. The level of confidence in the model outputs for under 15 metre vessels (outputs of Models 2 and 3) for each regional MCZ project area are examined in turn below.

H7.72 The Balanced Seas Project Area model: Overall, fishing activity by 47% of vessels under 15 metres that were active in the Balanced Seas Project Area are represented by FisherMap data (i.e. 47% of the vessels supplied data that were incorporated in to Fishermap). The mapped FisherMap data were verified initially with one association of fishers; however, the verification process was not found to be efficient, and therefore verification with other associations was not undertaken. The FisherMap outputs were validated by the commercial fishing representatives on the RSG and three local groups through face-to-face meetings and discussions over the phone. No concerns or issues regarding the representation of the data were identified, although the data for the Solent were not subjected to such detailed verification as the rest of the project area. Based on this, at the regional level, the Balanced Seas regional MCZ project estimates that there is a 'medium level of confidence' in the Fishermap data on fishing activity for the project area and therefore in the model outputs for under 15 metre vessels.

H7.73 The Finding Sanctuary Project Area model: Overall, 28% of vessels under 15 metres that were active in the project area are represented by FisherMap data (i.e. 28% of the vessels supplied data that were incorporated in to Fishermap). Informal verification of FisherMap outputs was obtained during the development of the survey outputs and was used to target survey effort in order to improve any areas identified as being less accurate. The final FisherMap outputs were not formally verified, but maps were shown to some fisheries representatives during consultation for the IA. In general stakeholders considered the maps to show a reasonable depiction of the relative level of fishing effort across the south-west region. Based on this, at the regional level, the Finding Sanctuary regional MCZ project estimates that there is a 'medium level of confidence' in the FisherMap data on fishing activity and therefore in the model outputs for under 15 metre vessels . Because activity by Cornish vessels was provided at a coarser level of detail (further discussion of this issue is provided in the section below on 'Regional variations'), model outputs for under 15 metre vessels for the Cornwall area are considered to have a 'low level of confidence'.

H7.74 The ISCZ Project Area model: Overall, 20% of vessels under 15 metres that were active in the ISCZ project area are represented by FisherMap (i.e. 20% of the vessels supplied data that were incorporated in to FisherMap). This coverage ranges from a minimum of 15% of vessels dredging for scallops to a maximum of 33% of mid-water trawlers. The mapped FisherMap data have been shared with and verified by associations of fishers, the North Western Inshore Fisheries and Conservation Authority (NWIFCA) and fisheries producer organisations around the ISCZ Project Area, as well as the regional stakeholder group. No concerns or issues regarding the representation of the data were identified. Based on this, at the regional level, the ISCZ regional MCZ project estimates that there is a 'high level of confidence' in the FisherMap fishing activity data for the project area and therefore the model outputs for under 15 metre vessels.

H7.75 The Net Gain Project Area model: Overall, 72% of vessels under 15 metres that were active in the project area are represented by FisherMap (i.e. 72% of the vessels supplied data that

were incorporated in to FisherMap). The mapped FisherMap data have been shared with and verified by associations of fishers, the Northumberland Inshore Fisheries and Conservation Area (NIFCA), MMO, members of the regional stakeholder group and the Net Gain senior liaison officer. Individuals generally considered the mapped outputs to provide a fair reflection of the relative distribution of fishing effort across the region. Given the high proportion of vessels included in the sample, and the positive verification process, at the regional level, the Net Gain regional MCZ project estimates that there is a 'high level of confidence' in FisherMap fishing activity data for the project area and therefore the model outputs for under 15 metre vessels.

H7.76 Some representatives of fisheries stakeholders were invited to provide feedback on the estimates of the values of landings for rMCZs provided by an early version of the MCZ Fisheries Model. In addition to estimates of values of landings for under 15 metre vessels, these estimates included estimates of values of landings for over 15 metre vessels that were based on processed VMS data for 2007 to 2009 (because 2010 VMS data were not available for use at that time). Subsequently, at the request of the Department for Environment, Food and Rural Affairs (Defra, pers. comm., 2010), VMS data were incorporated into the data used to estimate the value of landings for the IA. As a result, the estimates of the value of landings used in the IA differ from those that were validated by fisheries stakeholders.

Regional variations

H7.77 Each regional project constructed its own version of the MCZ Fisheries Model, which was used to calculate estimates of the value of landings for rMCZs in its region. Regional variations in inputs and outputs have resulted in regional variations in the model. The variations include those described below.

Finding Sanctuary variations

H7.78 In the Finding Sanctuary MCZ Fisheries Model, estimates were provided using only Models 1 and 3. Model 2 provides information on the distribution of the value of landings that is used in Model 3, and the value of landings for all vessels, regardless of whether they were interviewed by FisherMap, is then distributed via Model 3. The large spatial area covered in the south-west resulted in computer processing-capacity issues, and this regional variation was used as it reduced computer-processing requirements.

H7.79 For vessels fishing out of Cornish ports, the resolution of the data made available to Finding Sanctuary by FisherMap[10] was coarser than other FisherMap data. The data that were supplied were aggregate data for the fishers who were surveyed employing only two high-level gear classifications: mobile and static gear. This is a significantly coarser level of gear classification than that employed in other datasets that were collected for FisherMap(see the earlier discussion on 'Gear classification'). As a result the estimates of the value of landings for rMCZs off the coast of Cornwall are less reliable. In addition, details on the sample of vessels surveyed by FisherMap were not available.

H7.80 The Finding Sanctuary model uses a grid square of $^{3}/_{16}$nm (three sixteenths) by $^{3}/_{16}$nm for vessels under 15 metres, rather than a 1km by 1km grid (3/16nm is slightly less than 1km).

[10] Cornwall FisherMap was undertaken by the Cornish Fish Producers Organisation on behalf of Finding Sanctuary.

Balanced Seas variations

H7.81 There were no specific variations in the Balanced Seas MCZ Fisheries Model.

Net Gain variations

H7.82 In some instances (fewer than ten), records from FisherMap interviews provided information, including the value of landings, for vessels using pelagic trawls and hand lines, for which no corresponding records could be found on the iFISH database. In these instances, the value of landings data from the FisherMap interview was added to the data extracted from the iFISH database.

H7.83 Fishers who operate solely using a North Eastern Sea Fisheries Committee (NESFC) permit and do not use a fishing vessel were interviewed by FisherMap. Because they do not use a fishing vessel, it was not appropriate to include their data in the MCZ Fisheries Model. Data for these fishers was analysed separately and is included in the estimates employed in the IA.

H7.84 The model used to extract value of landings for over 15 metre vessels breaks gears into broad gear types (see Table 1). In order to separately indicate the value of landings accounted for by beam and otter trawling (relevant for rMCZ NG 6), an earlier version of the model was used, which does not include 2010 Vessel Monitoring System (VMS) data. In this earlier version of the model, the value of landings for beam and otter trawling for over 15 metre vessels is provided separately. The values of landings for beam and otter trawling for over 15 metre vessels were calculated as percentages of the value of landings for all bottom trawling. This percentage adjustment was then applied to the estimate for bottom trawling in the new version of the model in order to estimate the value of beam and otter trawling in the 2010 VMS data, which was then added to the under 15 metre values.

Irish Sea Conservation Zones project (Irish Sea) variations

H7.85 iFISH does not provide information on the value of fisheries that are not conducted with vessels. Estimates of the impact of rMCZs on non-vessel fishers working in the intertidal area were derived from their stated earnings, collected in FisherMap interviews. These estimates are the best available data for these fishers. The values were aggregated to ensure confidentiality of data for those involved. The values for fisheries that are not conducted with vessels are indicative only and may be underestimates or overestimates for the following reasons:

- The values gathered were for whole fishing grounds. Where an rMCZ intersects a fishing ground, the whole value of that ground is assumed to be affected.
- Values were collected from an estimated 30% of all intertidal fishers in the ISCZ project area. As the population of intertidal fishers at any rMCZ was not known, the estimates provided are only for the sample, and not for all intertidal fishers in the ISCZ project area.
- An inability to predict the spatial and temporal occurrence of shellfish beds means that it is very difficult to accurately identify the earnings of intertidal fishers and how this would change if MCZs were designated in intertidal areas. Trends indicate that one large bed is usually opened every 4 or 5 years, suggesting values in the region of £5m to £10m over 10 years.

Additional value of landings estimates

H7.86 As part of the work on the site recommendations and the IA, in some instances the representatives of fishers and fisheries and regulators have provided estimates for the value of landings that differ from those produced by the MCZ Fisheries Model. Where necessary, assumptions concerning these data and any details of calculations are provided in the spreadsheets for the calculations of impacts on fisheries (in Annex N) and/or the site-specific direct impacts on commercial fishing (in Annex I). Where these are presented in Annex I, the estimates from the MCZ Fisheries Model are also provided.

4.4 Estimating the economic impact

H7.87 Changes in the GVA from commercial fisheries are used in the IA to estimate the impact of rMCZs on the UK economy. Insufficient data were available to calculate impacts via changes to consumer and producer surplus (the measure used in conventional economic cost-benefit analysis), and GVA was used as an appropriate alternative. GVA has the benefit of being a less abstract measure than consumer and producer surplus and is more widely understood. GVA measures the contribution to the economy of each individual producer, industry or sector, and is used across government to measure national, regional and sub-regional economic performance (Wainman, Gouldson & Szary, 2010).

H7.88 Ideally, the change in GVA that arises from the impact of rMCZs would be calculated on the basis of changes in the costs and revenues for fishing vessels. These changes in costs and revenue will arise from changes in fishing patterns, steaming time, the species targeted, landings, gear types used, and from vessels leaving the fleet as a result of rMCZs. Insufficient data were available on which to base such calculations. Instead, the change in GVA was calculated on the basis of the amount of GVA that it is estimated would be generated by the value of landings that is affected by the management scenarios for an rMCZ. A crude assumption was made that the value of landings affected would be lost, and therefore so would its contribution to GVA. The income approach[11] to calculating GVA was used, because appropriate data for the calculations were available. GVA was defined as 'operating profit + crew share' (based on advice from the Joint Research Centre at the European Commission, pers. comm., 2011).

H7.89 The estimated change in GVA was calculated for each broad-scale gear type that is subject to additional management in the management scenarios for an rMCZ. It was calculated by multiplying the value of landings affected (estimated using the MCZ Fisheries Model) by an estimate of the percentage of total income (fishing income + non-fishing income) that is constitutes GVA ('GVA as a percentage of total income') for the relevant gear type/region. Details of the calculations carried out to estimate GVA affected are provided in Annex N.

H7.90 Table 3 (below) provides the estimates of GVA as a percentage of total income that were used in the calculations. The underlying data used to calculate the figures in Table 3 are provided in Table 4. The figures in Table 3 are mean values of the estimates of the percentage of total income that constitutes GVA ('GVA percentage') for each of the fleet segments associated with each broad-scale gear type over the period 2006 to 2009. The GVA percentage figures in Table 4 were calculated using data from Seafish economic surveys (Anderson and others, 2008; Curtis,

[11] Further details on the income approach can be found in Wainman, Gouldson & Szary (2010).

Metz & Brodie, 2009; Curtis, Brodie & Longoni, 2010; Curtis & Brodie, 2011), based on the following formula:

GVA as a percentage of value of landings = 100 / total income x (operating profit + crew share)

H7.91 As Table 2 shows, differences arise in the 'GVA as a percentage of total income' across fleet segments. This is because the financial structure and the performance of fleet segments vary across gear types, vessel sizes, regions and years.

H7.92 Seafish economic survey data were used because they provide the best available economic data for UK fishing fleets. The limitations of the data and of their use in providing estimates of impact on GVA include:

- The sample of vessels included in the Seafish economic surveys is not consistent from year to year.
- The vessels sampled by the surveys are self–selected. Because the sample is not random it cannot statistically be assumed to represent vessels in that segment. However, the data provided are the best available data.
- Data for a given fleet segment are not reported in the economic surveys if Seafish deems the sample size to be too small. Therefore data for all fleet segments are not available for all years.
- The specification of fleet segments can vary from year to year.
- The data that are available cover a short period (2006 to 2009), and so do not fully reflect the considerable annual variability in the economic performance of fleet segments.
- Total income, operating profit and crew share data include income earned by fishing vessels from sources other than fishing (non-fishing income).[12] Non-fishing income has been included, since the costs associated with non-fishing activities cannot be removed from the data. Non-fishing income typically makes up between 0% and 10% of total income, depending on the segment (Curtis & Brodie, 2011). Estimates from the MCZ Fisheries Model do not include non-fishing income, and this mismatch may result in further reduction in the appropriateness of the calculation GVA percentage figures. This may result in overestimates or underestimates of the impact on GVA for some fisheries.

Table 3 UK GVA as a percentage of total income, by gear type and region

Broad gear type (region)	UK GVA as a percentage of total income
Dredges (North Sea)	33
Dredges (south-west, south-east, Irish Sea)	39
Bottom trawls (North Sea)	30
Bottom trawls (south-west, south-east)	35
Bottom trawls (Irish Sea)	34
Mid-water trawls (all regions)	43
Pots (all regions)	40

[12] Non-fishing income is income earned from sources other than fishing. It includes undertaking guard duties for cable companies, towage activities and selling quota and days at sea.

Nets (all regions)	40
Lines (all regions)	47

Source: Regional MCZ projects' calculations, based on Seafish economic survey data.

Table 4 GVA as a percentage of total income (GVA percentage) for individual commercial fishing segments and the Seafish economic survey data used for the calculations

^ Each GVA percentage figure (far right column) was calculated by the regional MCZ projects based on the corresponding information in each row. All other information in the table is sourced from annual Seafish economic survey.

Gear type (region)	Seafish economic survey fleet segment	Total income (£m)	Crew share (£m)	Operating profit (£m)	GVA percentage
2006					
Dredges (North Sea)	NSWoS* scallop dredge	17.600000	5.000000	3.300000	47
Dredges (south-west, south-east, Irish Sea)	Area VII scallop dredge	18.200000	4.800000	2.900000	42
Bottom trawls (North Sea)	North Sea beam trawl >300kW	21.400000	4.300000	-0.400000	18
	North Sea beam trawl <300kW	n.a.	n.a.	n.a.	n.a.
	NSWoS demersal >24 metres	54.000000	8.100000	7.000000	28
	NSWoS demersal pairs (trawl/seine)	29.500000	6.200000	6.900000	44
	NSWoS demersal seiners (seine netters)	12.400000	2.500000	3.700000	50
	NSWoS demersal twin-rig trawl	14.400000	4.000000	0.600000	32
	NSWoS demersal <24 metres >300kW	12.500000	3.100000	2.700000	46
	NSWoS demersal <24 metres <300kW	n.a.	n.a.	n.a.	n.a.
	North Sea nephrops single-rig trawl	36.900000	8.400000	7.100000	42
	North Sea nephrops twin-rig trawl	23.700000	4.400000	6.300000	45
	WoS** nephrops single-rig trawl	17.600000	6.300000	0.500000	39
	WoS nephrops twin-rig trawl	5.900000	1.400000	1.600000	51
Bottom trawls (south-west and south-east)	South-west beam trawl >221kW >30 metres	7.500000	2.200000	0.800000	40
	South-west beam trawl >221kW <30 metres	13.700000	3.800000	-0.400000	25
	South-west beam trawl <221kW	n.a.	n.a.	n.a.	n.a.
	Area VIIdefg trawlers 10–15 metres	8.100000	1.800000	1.300000	38
	Area VIIdefg trawlers 15–40 metres	n.a.	n.a.	n.a.	n.a.
	Area VIIdefg trawlers 40 metres and over	n.a.	n.a.	n.a.	n.a.
Bottom trawls (Irish Sea)	Area VIIa nephrops single-rig trawl	7.500000	3.100000	-0.400000	36
	Area VIIa nephrops twin-rig trawl	8.300000	2.100000	1.300000	41
	Irish Sea demersal trawl >10 metres	3.100000	1.000000	-0.100000	29

Gear type (region)	Seafish economic survey fleet segment	Total income (£m)	Crew share (£m)	Operating profit (£m)	GVA percentage
Mid-water trawls (all regions)	Pelagic trawl 10–40 metres	4.700000	0.700000	2.200000	62
	Pelagic trawl 40 metres and over	112.000000	12.000000	44.100000	50
Pots (all regions)	Pots and traps 10–12 metres	16.600000	5.900000	0.900000	41
	Pots and traps 12 metres and over	21.500000	3.500000	4.200000	36
	Pots and creelers <10 metres	50.300000	26.000000	-2.700000	46
Nets	Gill netters	17.000000	3.600000	-0.600000	18
Lines	Longliners >10 metres	n.a.	n.a.	n.a.	n.a.
Segments not used in GVA calculations	<10 metres mobile and passive polyvalent	n.a.	n.a.	n.a.	-
	<10 metres demersal trawlers and seiners	13.300000	4.000000	0.600000	-
	<10 metres mobile other gears	n.a.	n.a.	n.a.	-
	<10 metres scallop dredge	2.600000	0.800000	-0.400000	-
	<10 metres passive gears other (any)	7.200000	2.700000	0.300000	-
2007					
Dredges (North Sea)	NSWoS scallop dredge >10 metres	19.690800	5.197200	1.860500	36
Dredges (south-west, south-east, Irish Sea)	Area VII Scallop dredge >10 metres	20.813200	5.282600	4.471300	47
Bottom trawl (North Sea)	North Sea beam trawl >300kW	29.858600	9.227600	0.117300	31
	North Sea beam trawl <300kW	2.877000	1.421700	0.012600	50
	NSWoS demersal >24 metres (single-rig trawl)	38.211000	8.529000	2.985000	30
	NSWoS demersal pairs (seine/trawl >10 metres)	29.374400	8.813200	2.956800	40
	NSWoS demersal seiners (seine netters >10 metres)	11.948200	3.691600	1.093400	40
	NSWoS demersal twin-rig trawl >10 metres	15.943600	3.744400	0.276000	25
	NSWoS demersal <24 metres >300kW (single-rig trawl)	14.274000	3.846000	1.576000	38
	NSWoS demersal <24 metres <300kW	3.852500	1.087500	-0.057500	27
	North Sea nephrops single-rig trawl >10 metres	12.874400	3.780700	1.424500	40
	N.Sea nephrops twin-rig trawl >10 metres	59.057600	16.060800	10.024000	44

Gear type (region)	Seafish economic survey fleet segment	Total income (£m)	Crew share (£m)	Operating profit (£m)	GVA percentage
	WoS nephrops single-rig trawl >10 metres	20.304600	6.308100	2.812200	45
	WoS nephrops twin-rig trawl >10 metres	10.297000	2.849000	0.847000	36
Bottom trawls (south-west and south-east)	South-west and English Channel beam trawl >221kW >30 metres	n.a.	n.a.	n.a.	n.a.
	South-west and English Channel beam trawl >221kW <30 metres	n.a.	n.a.	n.a.	n.a.
	South-west and English Channel beam trawl <221kW	n.a.	n.a.	n.a.	n.a.
	Area VIIdefg trawlers 10–15 metres	8.869400	1.677500	1.561600	37
	Area VIIdefg trawlers 15–40 metres	n.a.	n.a.	n.a.	n.a.
	Area VIIdefg trawlers 40 metres+	n.a.	n.a.	n.a.	n.a.
Bottom trawls (Irish Sea)	Area VIIa nephrops single-rig trawl >10 metres	9.674800	3.128900	0.770500	40
	Area VIIA nephrops twin-rig trawl >10 metres	n.a.	n.a.	n.a.	n.a.
	Irish Sea demersal trawl >10 metres	n.a.	n.a.	n.a.	n.a.
Mid-water trawls (all regions)	Pelagic trawl 10–40 metres	n.a.	n.a.	n.a.	n.a.
	Pelagic trawl 40 metres and over	n.a.	n.a.	n.a.	n.a.
Pots (all regions)	Pots and traps 10–12 metres	17.695800	5.794200	3.758400	54
	Pots and traps 12 metres and over	23.829300	7.553000	3.079300	45
	Potters and creelers < 9 metres (pots and traps)	28.413000	3.742200	1.663200	19
	Potters and creelers 9–9.99metres (pots and traps)	27.783000	6.520500	7.695000	51
Nets	Gill netters >10 metres	n.a.	n.a.	n.a.	n.a.
Lines	Longliners >10 metres	n.a.	n.a.	n.a.	n.a.
Segments not used in GVA calculations	9–9.99 metres passive polyvalent	10.948400	1.979600	2.585600	-
	9–9.99 metres demersal trawlers and seiners	15.592800	3.951600	1.735500	-
	9–9.99 metres beam trawl	n.a.	n.a.	n.a.	-
	<9 metres passive gears other	n.a.	n.a.	n.a.	-
2008					
Dredges (North Sea)	NSWoS scallop dredge (scallopers)	20.227285	3.890705	4.116710	40

Gear type (region)	Seafish economic survey fleet segment	Total income (£m)	Crew share (£m)	Operating profit (£m)	GVA percentage
Dredges (south-west, south-east, Irish Sea)	Area VII scallopers	22.040432	6.329713	5.440287	53
Bottom trawl (North Sea)	North Sea beam trawl >300kW	20.741664	5.281614	5.277708	51
	North Sea beam trawl <300kW	1.746002	0.873181	-0.396610	27
	NSWoS demersal >24 metres (single rig)	49.871530	10.956712	3.167728	28
	NSWoS demersal pairs (pair seine/trawl)	26.384846	7.463627	1.479845	34
	NSWoS demersal seiners (seine netters)	12.537842	3.493837	1.758942	42
	NSWoS demersal twin-rig trawl	19.331249	4.256610	1.617091	30
	NSWoS demersal <24 metres >300kW	20.951394	5.021613	2.712566	37
	NSWoS demersal <24 metres <300kW	5.499267	1.356351	0.882722	41
	North Sea nephrops single rig	6.828851	1.837059	0.678528	37
	N.Sea nephrops twin rig	56.156603	13.797936	7.334403	38
	WoS nephrops single rig	22.043453	5.500722	3.601177	41
	WoS nephrops twin rig	10.942963	2.380782	2.093977	41
Bottom trawls (south-west and south-east)	South-west beam trawl <221kW	7.271095	1.826474	0.514933	32
	South-west beam trawl >221kW	14.514717	3.826816	2.235964	42
	Area VIIdefg trawlers 10–15 metres	6.830831	2.481511	1.847491	63
	Area VIIdefg trawlers 15–40 metres	9.745256	3.396302	2.479676	60
Bottom trawls (Irish Sea)	Area VIIa demersal trawl	2.654697	0.557518	0.110674	25
	Area VIIa nephrops single-rig trawl	8.773540	2.675161	2.234628	56
	Area VIIA nephrops twin-rig trawl	7.017752	1.601251	1.727428	47
Mid-water trawls (all regions)	Pelagic 40 metres and over	n.a.	n.a.	n.a.	n.a.
Pots (all regions)	Pots and traps 10–12 metres	16.226091	4.089291	5.090544	57
	Pots and traps 12 metres and over	23.016594	5.651939	2.626233	36
	<10 metres pots and traps	56.993232	14.922720	24.088944	68
Nets	Gill netters	10.890982	3.396302	1.557303	45
Lines	Longliners	6.760476	1.721473	1.720200	51
Segments not used in GVA calculations	<10 metres passive other	16.669673	3.922007	5.624394	-
	Low activity 10 metres and over	n.a.	n.a.	n.a.	-

Gear type (region)	Seafish economic survey fleet segment	Total income (£m)	Crew share (£m)	Operating profit (£m)	GVA percentage
	Low activity <10 metres	n.a.	n.a.	n.a.	-
	<10 metres demersal trawl/seine	12.977094	3.311507	1.625417	-
	<10 metres mobile other	3.303532	1.061715	0.476515	-
	Miscellaneous	n.a.	n.a.	n.a.	-
2009					
Dredges (North Sea)	NSWoS scallop dredge	17.242148	4.004756	3.657832	44
Dredges (south-west, south-east, Irish Sea)	Area VII Scallop dredge	23.997807	6.233132	5.144644	47
Bottom trawl (North Sea)	North Sea beam trawl >300kW	n.a.	n.a.	n.a.	n.a.
	North Sea beam trawl <300kW	1.703328	0.398199	0.077152	28
	NSWoS demersal >24 metres	59.587467	13.757101	4.914359	31
	NSWoS demersal pairs	28.248759	7.743430	2.371383	36
	NSWoS demersal seiners	15.318270	3.842352	2.294390	40
	NSWoS demersal <24 metres >300kW	29.807705	6.656706	3.503550	34
	NSWoS demersal <24 metres <300kW	5.977556	1.695378	0.600810	38
	North Sea nephrops >300kW	39.717741	9.270214	6.223665	39
	North Sea nephrops <300kW	16.344860	3.635308	1.968958	34
	WoS nephrops >250kW	7.273248	1.819231	0.234746	28
	WoS nephrops <250kW	15.418647	3.248528	3.621744	45
Bottom trawls (south-west and south-east)	South-west beam trawl <250kW	7.701795	1.959853	1.360230	43
	South-west beam trawl >250kW	7.226271	1.950884	0.840901	39
	Area VIIb-k trawlers 10–24 metres	n.a.	n.a.	2.372270	n.a.
	Area VIIb-k trawlers 24–40 metres	13.379809	2.440185	n.a.	n.a.
Bottom trawls (Irish Sea)	Area VIIa demersal trawl	0.623074	0.097984	0.140934	38
	Area VIIa nephrops >250kW	6.606420	1.211888	1.137797	36
	Area VIIa nephrops <250kW	5.980167	1.743415	1.305546	51
Mid-water trawls >10m (all regions)	Pelagic 40 metres and over	n.a.	n.a.	n.a.	n.a.

Gear type (region)	Seafish economic survey fleet segment	Total income (£m)	Crew share (£m)	Operating profit (£m)	GVA percentage
Pots (all regions)	Pots and traps 10–12 metres	16.822810	4.571947	6.057898	63
	Pots and traps 12 metres and over	24.074835	6.389208	5.648051	50
	<10 metres pots and traps	46.441937	11.318944	18.132626	63
Nets	Gill netters	13.935024	4.112580	2.880757	50
	<10 metres drift/fixed nets	10.074504	3.074378	3.367897	64
Lines	Longliners	n.a.	n.a.	n.a.	n.a.
	<10 metres hooks	3.591095	0.899793	1.490085	67
Segments not used in GVA calculations	Low activity 10 metres and over	n.a.	n.a.	n.a.	-
	Low activity <10 metres	n.a.	n.a.	n.a.	-
	<10 metre demersal trawl/seine	12.900776	3.170252	4.086617	-
	<10 metre mobile other	n.a.	n.a.	n.a.	-
	Miscellaneous	n.a.	n.a.	n.a.	-

* NSWoS: North Sea and West of Scotland.

** WoS: West of Scotland

4.5 Number of Vessels

H7.93 Estimates of the number of vessels, by gear type, active within an rMCZ and therefore affected by rMCZ management were drawn from a number of different sources. The sources were:

- Fishermap: These figures represent the number of vessels within the Fishermap sample who stated that they fish within the rMCZ. As such Fishermap information is likely to be an underestimate of the true number of vessels active in an rMCZ.;

- MMO iFISH database: Vessel numbers from the MMO iFISH database are at the spatial scale of ICES Rectangles. rMCZs often cover only small proportions of ICES Rectangles and as such vessel numbers from this source may significantly overestimate the true number of vessels. Where rMCZs cover a significant proportion of an ICES Rectangle the estimates may be more accurate;

- Stakeholder consultation: during consultation stakeholders were asked to provide estimates of the number of vessels (by gear type) active within rMCZs. Where stakeholders new the sites well, they were often able to give good estimates, specifying each individual vessel active within the site (information on individual vessels has not been published).

H7.94 The source used varies depending on which was judged to give the best estimate for individual sites and regions. The following sets out the approach taken by each regional MCZ project:

- Balanced Seas: estimates for both under 15 metre and over 15 metre vessels are provided based on estimates provided by fisheries stakeholders, where available. Given the unknown extent of potential underestimates and overestimates from Fishermap and the MMO iFISH database, these figures were considered to be potentially misleading and were therefore not included;

- Finding Sanctuary: estimates for both under 15 metre and over 15 metre vessels are provided based on estimates provided by fisheries stakeholders, where available. Given the unknown extent of potential underestimates and overestimates from Fishermap and the MMO iFISH database, these figures were considered to be potentially misleading and were therefore not included. For offshore sites which cover significant proportions of ICES Rectangles (e.g. >80%), the number of vessels (over and under 15 metres) reported as fishing within the ICES Rectangle wereset out in the baseline, recognised as potentially fishing within the rMCZ;

- ISCZ: estimates for both under 15 metre and over 15 metre vessels were taken from Fishermap. In addition, where available, estimates provided by fisheries stakeholders were also included. Appropriate caveats that recognise the potential for underestimates by the Fishermap data were included in Annex I for each rMCZ;

- Net Gain: estimates for the number of under 15 metre vessels were taken from Fishermap. Estimates were not provided for the number of over 15 metre vessels. Net Gain Fishermap

data was not considered to have a sufficiently large sample to provide meaningful estimates for over 15 metre vessels. MMO iFISH database figures as the figures may be misleading given the unknown extent of the potential overestimates that may result for rMCZs.

5 Qualitative assessment of the impact of rMCZs on the UK commercial fishing sector

H7.95 A series of group and one-to-one meetings was carried out by each regional MCZ project with UK fishers and representatives and regulators of the UK commercial fishing sector, in order to obtain information on the economic and social impacts of rMCZs.

5.1 The sample

H7.96 Interviewees, including fisheries representatives and fishers, thought to have good knowledge on the fisheries potentially affected by rMCZs (the rMCZ areas fished and the gear types likely to be affected by the management scenarios) were initially selected. They were selected so that information could be collected on all the rMCZs and the fisheries within them.

H7.97 The interviewees were selected by the regional MCZ project economists and fisheries liaison officers. The regional MCZ project fisheries liaison officers were all fishers or ex-fishers. They had previously conducted the FisherMap survey, and had provided ongoing information on the MCZ project to fishers. Thus they were able to advise on an appropriate sample of individuals to interview and who would be able to provide informed views on fisheries operating in the rMCZs and that deployed the gear types that could be affected by the rMCZ management scenarios.

H7.98 The regional MCZ project teams estimated the number of individuals who needed to be interviewed in order to achieve adequate cover of the rMCZs and gear types potentially affected. The number and distribution of rMCZs in each region influenced the number of individuals that each regional project team included in its sample.

H7.99 During the interview process, additional interviewees were sometimes identified. This ‘snowball’ sampling approach was implemented in instances where specific issues were identified for which further information was required. It allowed the inclusion in the sample of individuals who held particularly relevant information and who either were not known to the regional MCZ project teams, or who had not previously been accessible to the teams, thereby improving the quality of information obtained from the survey.

H7.100 Time and resource limitations meant that the overall sample size was small. Interviews were conducted either with groups of interviewees or in one-to-one meetings. Information wasl collected from a total of 12 individuals/organisations in the Balanced Seas project area, 30 individuals/organisations in the Finding Sanctuary project area, 4 organisations in the Irish Seas Conservation Zone project project area and 11 organisations in the Net Gain project area. The number of individuals/organisations interviewed varied by region, in line with the differences in the number and area of the rMCZs being considered, and the heterogeneity of regional fishing fleets.

H7.101 Resources were targeted in order to obtain qualitative information on all rMCZs where additional management scenarios were identified, and were further concentrated on those rMCZs where the MCZ Fisheries Model, or other evidence, indicated the greatest impact.

5.2 The interview

H7.102 Interviews were undertaken during July, August and September 2011 at a time and place preferred by the interviewee. Additional scenarios that were added to the IA for some sites (following provision of further advice by JNCC and Natural England) after this period were not included in these discussions. Information from the interviews was recorded as written meeting notes. Where resources were available, an observer attended, in order to record meeting notes.

H7.103 Prior to the interviews, an interview prompt sheet (Table 5) was developed to ensure that all key issues were covered in the discussion. A draft version of the interview prompt sheet was sent to the National Federation of Fisheries Organisations (NFFO), Seafish, Cefas, Natural England, JNCC and Defra prior to the interviews, and feedback was requested on the appropriateness of the information being sought. Prior to the interviews, the prompt sheet was revised to incorporate the feedback from these organisations and to streamline the level of detail included.

H7.104 In advance of the interview, each interviewee was provided with charts of the rMCZs, including DECCA lines and/or geographic co-ordinates, and the scenarios for fisheries management that had been suggested for use in the IA at that time. This material was also available to interviewees during the meeting.

H7.105 Background to the MCZ project was provided, as necessary, at the beginning of each interview. This included an overview of the management scenarios being considered in the IA, and the basis for and status of the scenarios. The purpose of the interview was explained, and, when providing information on the impact on commercial fishing activities, the interviewee was asked to assume that the management scenarios would be enforceable and effective. Depending on the status of the interviewee, they were asked to provide information on their own fishing activities and/or on the activities of fishers whom they represented or regulated.

H7.106 Semi-structured interviews were conducted. This technique was chosen because it allowed the interviewer the flexibility to pursue certain questions in greater depth, depending on the knowledge of the interviewee and the significance of the impacts. Impacts were discussed at the scale of individual rMCZs and groups of rMCZs, depending on the issue being considered. The interviewer employed an interview prompt sheet (Table 4) to ensure that all key issues were covered in the discussion.

H7.107 The key aspects covered in each interview were:

- current fishing patterns;
- anticipated impacts of the suite of recommended rMCZs in the region, including:
  - displacement of fishing effort;
  - gear adaptation and changing gear type;
  - fishers changing target species;
  - vessels leaving the local fleet;

- impact on vessels not targeted by rMCZ management; and
- impact on upstream and downstream businesses.

Table 5 Fisheries interview prompt sheet

Name of interviewee(s):	**Date:** **Location:**
Fleet represented:	**No. Vessels (PT/FT):**
Gear types:	**No. Crew (PT/FT):**
Home ports	**rMCZs:**
Data protection – please see accompanying statement.	
1. Review Site boundaries (with co-ordinates), activity restrictions and management measures. The current pattern of fishing in and around the rMCZ. Feedback on the value of landings estimates from the MCZ Fisheries Model (asked of IFCA and MMO representatives only). Discuss what they think about the proposals and, broadly speaking, the types of impact these could have. Check that they will be captured below.	
2. Vessels adapting within site To what other gear type or target species? What effect will changing gear or target species within the site have on these vessels? Effect on other vessels? Barriers and opportunities?	
3. Vessels displaced from site What effect will displacement have on these vessels? Where will they go? (use chart) Will any change gear type or target species? Effect on other vessels? Barriers and opportunities?	
4. Vessels leaving the fleet Would any leave the fleet and why? Barriers and opportunities for other employment of vessels or individuals? What effect will this have on these vessels, others, families, local community?	
5. Vessels continuing as usual Would any continue to fish in the site? How do you think they would be affected?	
6. Impacts on businesses that service and supply fishing vessels How could they be affected by rMCZs?	
7. Impacts on supply chain How could the regional, national and international supply of fish and fish products be affected? Short, medium and long term? Where might any shortfall be met from?	
8. Any other comments… Baseline trend of fishing fleet, cumulative impact of government policy and other industries, way forward for fishing	

5.3 Use of the survey information

H7.108 The information gathered from the survey was used to in the IA material in conjunction with other qualitative information gathered over the course of the regional MCZ projects' work.[13] The information provided was used to:

- inform the qualitative description of the baseline for fisheries (the situation in the absence of MCZs) at the scale at which the information was provided (individual rMCZ, group of rMCZs, regional suite of rMCZs and/or national suite of rMCZs; and
- provide a qualitative description of the anticipated impacts of rMCZ management scenarios on UK commercial fishers. This information has been reported at the rMCZ, group of rMCZs, regional and/or national level, as appropriate.

H7.109 The limitations of the qualitative assessment included the following:

- The sampling approach did not use a random sample and so the information provided by the sample cannot statistically be assumed to represent all affected vessels in that fishery.
- As many of the interviewees had been involved in the MCZ project to some degree, some bias may be present in their responses, which is likely to be affected by their level of support for the MCZ process.
- Many of the questions about anticipated impacts required interviewees to make judgements about decisions that may be taken by fishers in future. This is difficult for interviewees to do, particularly if they do not actively fish. Consequently, there is a low level of confidence in the qualitative assessments of impacts. However, it is the best information that is available.
- Interviewees may have given opinions on impacts for issues about which they were not fully informed, thereby potentially providing misleading information.
- Differences in the spatial scale at which information was provided and collected from different interviewees means that the extent of qualitative discussion of the impacts is not consistent either between individual rMCZs or across different spatial scales.

6 Assessment of impacts on non-UK commercial fishing

6.1 Quantitative assessment of the impacts

H7.110 A partial quantitative assessment of the impact on non-UK fishing vessels was carried out for the rMCZs and EU member states for which data could be obtained. The quantitative information used in the assessment was obtained through international engagement undertaken by JNCC on behalf of the regional projects (a description of engagement undertaken is provided below). The MMO agreed to submit official requests to EU member states for landings/landing value data from non-UK vessels landing into non-UK ports. However, at the time of writing no such information was forthcoming to the regional MCZ projects.

[13] Information was gathered informally over the course of the regional projects' duration, through discussions held at MCZ planning meetings and consultation carried out to inform early iterations of the Impact Assessment.

H7.111 EU member states provided some information on value of landings and the number of vessels affected. The detail of the information provided differed for each member state. As a minimum, estimates of the value of landings for particular groups of rMCZs were provided. The groups did not necessarily equate to all of the rMCZs where a particular country's vessels were active. The best available information provided for each rMCZ and group of rMCZs is included in the relevant sections of the IA. It has not been possible to verify the methodologies used by member states to establish the value of landings and vessel number estimates.

H7.112 As information was not obtained for all rMCZs within which EU member states fish, available VMS data for the period 2006 to 2009 (Lee, 2010) were interrogated to provide an indication of whether the vessels of a member state might be affected.

H7.113 Relatively comprehensive data were provided for French vessels by the Comité National des Pêches Maritimes et des Elevages Marins (CNPMEM) via a password-protected Direction des Pêches Maritimes et de l' Aquaculture (DPMA) website (Direction des Pêches Maritimes et de l' Aquaculture, 2011). The website provided value of landings information separately for 2007 and 2008, by gear type, on a chart at the scale of VMS squares, over which the rMCZ shapes had been drawn. Estimates for French vessels of the value of landings from an rMCZ were made, based on the following process:

- Data were manually extracted from the website for each VMS square that overlapped with an rMCZ. The value of landings attributed to a VMS square for the selected gear type and year was shown on screen by hovering the computer mouse over each VMS square.
- An estimation of the proportion of a VMS square within an rMCZ shape was made by eye, using the following broad categories: 0%, 25%, 50%, 75% or 100%. As the estimate was made by eye, a more refined scale was not considered appropriate. GIS layers of the information, which would have allowed a more accurate estimate, could not be obtained.
- The proportion of the VMS square estimated to be inside an rMCZ was applied to the relevant value of landings figure to provide an estimate of the value of landings from within the rMCZ. This assumes that landings are evenly distributed across a VMS square.
- An average of the estimates for 2007 and 2008 was taken to provide an average annual value.
- This figure was converted from Euros into Sterling using average annual exchange rates (see Annex N for rates) (Bank of England, 2012).

H7.114 The data are presented in the IA by groups of broad-scale gear types, as set out in Table 5 below.

Table 6 Gear types

Gear type group	DPMA gear category
Mobile (benthic)	**Active** Dredges Glass eel sieve Trawls **Seines** Danish seines Scottish seines
Static	**Passive** Lines Long lines Nets Pots and traps
Other	Faggot Gear not known or not specified Miscellaneous gears
Collection by hand	Scuba-diving
Mid-water trawls	Purse seines

H7.115 There are a number of limitations concerning the quantitative assessment for other EU member states:

- Quantitative data are incomplete and therefore not available for all relevant rMCZs. Thus quantitative estimates of the impact on EU member states are either not available or are underestimated.
- Methods used by member states could not be checked or verified.
- A number of manual estimation techniques were necessarily employed in order to obtain estimates of French values of landings, which may result in significant estimation errors.

6.2 Qualitative assessment of the impacts

H7.116 The engagement of non-UK fishers in work for the IA varied, depending on the resources available to each fishing fleet to engage with each of the four regional MCZ projects, and also depending on their expectations about whether they would be affected by MCZs. In early 2010, JNCC undertook an engagement exercise that aimed to overcome these barriers and encourage non-UK fisheries representatives to engage with the MCZ stakeholder recommendations process and to inform assessments for the IA.

H7.117 JNCC contracted the Institute of European Environmental Policy (IEEP) to identify key representatives of non-UK fishers whose interests were likely to be impacted upon by MCZs. Engagement was targeted at these individuals to give them the opportunity to inform the stakeholder recommendations and provide input to the IA. Additional contacts were identified by JNCC through meetings with the North Western Waters Regional Advisory Council, the North Sea

Regional Advisory Council, and the Pelagic Regional Advisory Council, and through the Marine Protected Areas in the Atlantic Arc project.

H7.118 A qualitative assessment of the impact on non-UK fishing vessels was carried out by JNCC on behalf of the regional MCZ projects. JNCC organised meetings with the representatives of fisheries in countries that are expected to be affected by the designation of MCZs. The purpose of the meetings was to assist fisheries representatives in completing IA questionnaires provided by the regional project economists, as well as to offer an update on the MCZ project. Over the period from July to October 2011, information was collected from those representatives that accepted the request. The completed questionnaires were collated and supplied to the regional MCZ projects and used to inform the qualitative assessment of impacts.

H7.119 A summary of engagement in the MCZ site recommendation process and provision of information for the IA is provided for each country below:

- **The Belgian fleet** had representation on the ISCZ and the Balanced Seas regional stakeholder groups. Two representatives also attended sub-regional meetings in the ISCZ regional project. The Belgian fleet was also a named consultative stakeholder on the Net Gain regional project. In 2011, JNCC liaison officers met 8 Belgian fishers to complete the IA questionnaire. The Belgian fleet has focused its efforts primarily on the ISCZ and the Balanced Seas regional project recommendations. However, it still has considerable concern about the impact on its fishing interests of MCZ designation in the south-west and the North Sea.

- **The Dutch fleet** had representation on the Balanced Seas regional project stakeholder group. It was also a named consultative stakeholder for the Net Gain regional project (although it subsequently became a member of the Net Gain regional hubs, in order to gain greater influence within the planning process). Two representatives and approximately 40 fishers attended a meeting with JNCC liaison officers to provide information for the IA questionnaire. The questionnaire was completed by a fisheries representative.

- **The French fleet** had representation on the Balanced Seas regional stakeholder group and was a named consultative stakeholder on the Net Gain and Finding Sanctuary projects (subsequently becoming a member of the Net Gain regional hubs). The Comité Regional des Pêches Maritimes et des Elevages Marins (CRPMEM – regional fisheries committee) from Brittany had limited capacity to engage in the Finding Sanctuary regional stakeholder group, despite having concerns that its fishers may be impacted by MCZ designation in this region. During meetings in France in 2011, JNCC liaison officers met the different CRPMEMs from Calais-Picardie, Haute and Basse-Normandy and Brittany, to update them on the MCZ stakeholder recommendation process and to complete the IA questionnaire. The Calais-Picardie, Haute and Basse-Normandy fisheries representatives completed an IA questionnaire. Although the Brittany fleet is the largest French fleet and has a high degree of fishing effort in the south-west region, no IA was received from CRPMEM-Brittany.

- **The Danish fleet** had named consultative stakeholder representation on the Net Gain regional project. Three fisheries representatives contributed to the IA questionnaire.

- **The Spanish fleet** – in December 2011, Spanish fishing co-operatives from Galicia (Puerto de Celeiro, the Asociación Armadores de Buques de Pesca en El Gran Sol, the

Organización de Productores de Pesca de Altura del Puerto de Ondárroa, and the Organización de Productores Pesqueros de Lugo) completed the MCZ impact assessment questionnaire provided by JNCC. They planned to engage with JNCC in January 2012; however a change of government in Spain meant they were not able to meet with the JNCC.

- **The Irish Fleet** – JNCC began meeting and engaging with Irish representatives in autumn 2010; however, there has been little active engagement by the Irish fleet in the MCZ stakeholder recommendation process. JNCC liaison officers met a number of representatives in Dublin in early 2012. The participants chose not to fill in the questionnaire on the day, but took it away for further consideration. However, to date, no information has been provided.

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Appendix 1

Advice provided by JNCC and Natural England on fisheries management for the purposes of the IA for MCZ

H7.A1 Advice on the fisheries management scenarios for the purposes of the Impact Assessment for MCZs has been provided by JNCC and Natural England in various documents. The advice on fisheries management scenarios for rMCZs that are not rMCZ Reference Areas is provided in the following four documents:

a. Advice on fisheries management scenarios supplied on 13 October 2011. An interpreted version of this is provided below.

b. Draft advice on identification of the extent to which fisheries may need restriction in MCZs (JNCC & Natural England, 2011b). A copy of this is provided below.

c. Advice from JNCC and Natural England with regard to the impact of fisheries on Marine Conservation Zone habitat features (JNCC & Natural England, 2011a). This is not included here because of the size of the document, but a URL is supplied.

d. Advice on diver fishing and shellfish lays provided in JNCC & Natural England (2011c). This is not included here because of the size of the document, but a URL is supplied.

H7.A2 Note that both (a) and (b) generically apply the advice provided in (c).

H7.A3 The advice on rMCZ Reference Areas is provided in JNCC & Natural England (2010).

H7.A4 The advice was applied as follows to inform the development of scenarios used for fisheries management in material for the IA:

- The advice identified in (c) and (d) above was used in vulnerability assessment discussions to identify management scenarios (Finding Sanctuary Project Area only).
- The advice on fisheries management scenarios supplied on 13 October 2011 was applied first (for Finding Sanctuary, the existing management scenarios were augmented by outputs from the application of this new advice).
- For features that were not listed in table 2 of that advice, the draft advice on identification of the extent to which fisheries may need restriction in MCZs (see below) was applied.
- Where the suggested fisheries management scenarios for a fishing gear different across features within a pMCZ, the most stringent management was employed in the IA.

H7.A5 The regional projects were not fully aware of how JNCC and Natural England anticipated that the advice provided in (c) would apply to rMCZs until a late stage in work on the IA. Some of the additional fisheries management that JNCC and Natural England advised should be considered in the IA (as set out in (a)) did not become apparent until October 2011.

Interpretation of advice on fisheries management scenarios supplied by JNCC for the purposes of the IA for MCZs on 13 October 2011

The advice originally supplied by JNCC has been interpreted to provide clarification. The interpretation involved altering the presentation of information and adding explanatory text. The substantive content of JNCC's original advice has not been altered. Please note the addendum provided at the end of this document.

H7.A6 The advice was provided to estimate potential impacts for the purposes of the IA. It does not pre-judge the fisheries management that will be required for MCZs. Fisheries management that will be needed for MCZs will not be identified until after the sites are designated and may need to be informed by further investigations (the costs of which are included in the 'Monitoring' section of the IA). It may differ from the management scenarios that have been employed to estimate impacts for the purposes of the IA.

H7.A7 Advice was provided on management scenarios for pelagic fisheries and angling in rMCZ Reference Areas beyond 12nm and on management scenarios for bottom trawls, dredges, pots, lines, nets and traps for certain rMCZ features that have a conservation objective of 'recover'.

Management scenarios for pelagic fisheries and angling in Reference Areas beyond 12nm

H7.A8 JNCC's advice on the fisheries management scenarios that should be employed for the purposes of the IA for rMCZs for pelagic fisheries and angling in rMCZ Reference Areas beyond 12nm is provided in Table A1 (below).

H7.A9 For most offshore rMCZ Reference Areas, there is insufficient scientific evidence that pelagic fishing or demersal angling will impact on features protected by the sites. JNCC considers it unlikely that additional management of these gear types will be needed. Following discussions between Defra and JNCC, it was decided that two management scenarios should be used:

1. No additional management of pelagic fisheries and angling is required in rMCZ Reference Areas.

2. Closure of rMCZ Reference Areas to pelagic fisheries and angling is required.

H7.A10 The above management scenarios for pelagic fisheries and angling were applied to rMCZ Reference Areas situated in water depths greater than 50 metres. Taking a precautionary approach, in shallow rMCZ Reference Areas, with water depths of less than 50 metres, there is a potential risk that removal of pelagic or demersal species may prevent designated benthic features from achieving reference condition. Any fishery (including recreational angling) that targets demersal fish species could pose a risk to designated benthic features achieving reference condition, assuming that those demersal species play a direct role in the benthic ecosystem.

Table A1 JNCC advice on management scenarios that should be employed, for the purposes of the IA, for pelagic fisheries and recreational angling in rMCZ Reference Areas beyond 12nm*

Regional MCZ project	rMCZ	Advice on fisheries management scenarios that should be employed for the IA for MCZs
Irish Sea	rMCZ Reference Area B North St George's Channel	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Irish Sea	rMCZ Reference Area C Mid St George's Channel	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Irish Sea	rMCZ Reference Area F South Rigg	Mid-water trawling – closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Irish Sea	rMCZ Reference Area G Slieve Na Griddle	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Irish Sea	rMCZ Reference Area S North St George's Channel	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Irish Sea	rMCZ Reference Area Mud Hole	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Finding Sanctuary	rMCZ Reference Area The Canyons	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – no additional management. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Finding Sanctuary	rMCZ Reference Area Haig Fras	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Finding Sanctuary	rMCZ Reference Area Celtic Deeps	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.

Regional MCZ project	rMCZ	Advice on fisheries management scenarios that should be employed for the IA for MCZs
Finding Sanctuary	rMCZ Reference Area South Dorset	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Finding Sanctuary	rMCZ Reference Area Cape Bank	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Balanced Seas	rMCZ Reference Area 10, Dolphin Head	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Balanced Seas	rMCZ Reference Area 14, Wight-Barfleur	Mid-water trawling – closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – closed to these gears.
Net Gain	rMCZ Reference Area 8, Wash Approach	Mid-water trawling – closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – closed to these gears.
Net Gain	rMCZ Reference Area 10, Compass Rose	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Net Gain	rMCZ Reference Area 12, Farnes Clay	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Net Gain	rMCZ Reference Area 13, Rock Unique	Mid-water trawling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears. Demersal angling – closed to these gears. Pelagic recreational angling – **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.

* Demersal angling refers to angling that targets demersal species and pelagic angling refers to angling that targets pelagic species. Based on data relating to line and net fisheries, JNCC identified that there are no pelagic line or net commercial fisheries currently operating in any of the proposed reference areas beyond 12nm. The scenarios are therefore assumed to apply only to commercial mid-water trawling and recreational pelagic angling.

Management scenarios for bottom trawls, dredges, pots, lines, nets and traps for certain rMCZ features that have a conservation objective of 'recover'

H7.A11 JNCC's advice on the fisheries management scenarios that, for the purposes of the IA for MCZs, should be employed for bottom trawls, dredges, pots, lines, nets and traps for rMCZs beyond 12nm is provided in Table A2. Natural England agreed that this advice should also be applied to rMCZs within 12nm. Note that this advice only applies to the specified features if they have a conservation objective of 'recover'.

H7.A12 The advice provided in JNCC & Natural England (2011a) has been applied by JNCC here as follows:

- If the fisheries management advice given for a feature for the 'unrestricted access' option with a **recover** objective is 'this option will (or may) help to achieve the conservation objective' or 'this option will (or may) help to achieve the conservation objective but with a potential risk of deterioration', it may be assumed that no further management will be necessary.
- If the fisheries management advice given for a feature for the 'managed access' option with a **recover** objective is 'no suitable management options could be identified' (n/a), it may be assumed that JNCC will advise complete closure to the specified gear.
- If the fisheries management advice given for a feature for 'managed access' with a **recover** objective is 'If appropriate management is applied, this option will (or may) help to achieve the conservation objective', it may be assumed that there is uncertainty about whether additional management is required.

H7.A13 There is insufficient scientific evidence that demersal trawls, dredges, lines, nets, pots and traps will impact on certain benthic features. As a result, there is uncertainty about whether additional management of fisheries will be needed. If it **is** needed, there is uncertainty about whether an experimental closure might initially be required (to determine the responses of features to the removal of pressures), about the number of replicates that would be required and about the area of the features the closure would apply to. If it is identified that additional management will be needed (without an experimental closure or following the closure), there is uncertainty about the area of the features that the management would apply to.

H7.A14 To reflect the uncertainty in the management that may be needed, JNCC suggested that the IA should employ a scenario that involved an arbitrary average reduction in pressure for the gear types concerned of 50%. It was to have been assumed that this would result in a 50% reduction in the value of landings. However, Defra advised that, because the average level of reduction in pressure that will be needed is not known, rather than use an arbitrary estimate, the full potential range of reduction in effort should be employed in the IA. Consequently, two scenarios are suggested where there is uncertainty that additional management of gears is needed:

- a low-cost scenario of no additional management (which has no impact on the value of landings); and
- a high-cost scenario that involves closure of the site to that gear.

H7.A15 Because this represents the full possible range of restrictions on a gear, the restriction that would apply will necessarily fall within this range. However, the range involves extremes that may be unlikely to apply to specific sites.

H7.A16 Where the advice suggests a low-cost scenario and a high-cost scenario for both sets of gears for an rMCZ, these have been combined into two scenarios:

- no additional management for bottom trawls, dredges, nets, lines, pots and traps; and
- closure to bottom trawls, dredges, nets, lines, pots and traps.

Table A2 JNCC and Natural England's advice on management scenarios that should be employed, for the purposes of the IA, for bottom trawls, dredges, lines, nets, pots and traps for all rMCZs (excluding rMCZ Reference Areas)

Please note the addition to this table provided in the Addendum at the end of this document.

Feature with a conservation objective of 'recover' that is protected by the rMCZ	**Assumption for bottom trawls and dredges**	**Assumption for lines, nets, pots and traps**
High energy circalittoral rock	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Moderate energy circalittoral rock	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Low energy circalittoral rock	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Sub-tidal coarse sediment (stable or unknown stability)	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	No additional management required.
Sub-tidal coarse sediment (unstable)	No additional management required.	No additional management required.
Sub-tidal sand (low or unknown energy)	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-**	No additional management required.

Feature with a conservation objective of 'recover' that is protected by the rMCZ	Assumption for bottom trawls and dredges	Assumption for lines, nets, pots and traps
	cost scenario: closed to these gears.	
Sub-tidal sand (high energy)	No additional management required.	No additional management required.
Sub-tidal mud	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	No additional management required.
Sub-tidal mixed sediments	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Deep-sea bed	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Blue mussel *Mytilus edulis* beds (including intertidal beds on mixed and sandy sediments)	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	No additional management required.
Burrowed mud	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	No additional management required.
Cold-water coral reefs	Closed to these gears.	Closed to these gears.
Fragile sponge and anthozoan communities on sub-tidal rocky habitats	Closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Horse mussel *Modiolus modiolus* beds	Closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.

Feature with a conservation objective of 'recover' that is protected by the rMCZ	Assumption for bottom trawls and dredges	Assumption for lines, nets, pots and traps
Mud habitats in deep water	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	No additional management required.
Sea-pen and burrowing megafauna communities	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	No additional management required.
Peat and clay exposures	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Ross worm *Sabellaria spinulosa* reefs	Closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.
Sheltered muddy gravels	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.	Uncertain whether management will be required. **Low-cost scenario:** no additional management. **High-cost scenario:** closed to these gears.

References

JNCC & Natural England. 2010. Marine Conservation Zone Reference Areas: Guidance document for regional MCZ projects. URL: www.naturalengland.org.uk/Images/MCZ-regional-guidance_tcm6-23451.pdf [Accessed 8 May 2012].

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JNCC & Natural England. 2011c. *General advice on assessing potential impacts of and mitigation for human activities on MCZ features, using existing regulation and legislation*. URL: http://jncc.defra.gov.uk/pdf/MCZ_ActivitiesAdvice_Final.pdf [Accessed 8 May 2012].

Addendum

H7.A17 The following table provides additional information to that provided in the preceding document presented in Table A2 (Interpretation of advice on fisheries management scenarios supplied by JNCC for the purposes of the IA for MCZs on 13 October 2011). It presents advice on habitats found only within 12nm that was provided by Natural England to the regional MCZ projects in April 2012. It was supplied to ensure that the advice provided by Natural England and JNCC was consistent across all habitats.

Table A3 Natural England's advice on management scenarios that should be employed, for the purposes of the IA, for dredges, bottom trawls, lines, nets, pots, traps, hand raking and bait collection for all rMCZs (excluding rMCZ Reference Areas)

Feature with a conservation objective of recover that is protected by the pMCZ	**Assumption for dredges (including hydraulic and tractor dredge)**	**Assumption for bottom trawls**	**Assumption for lines, nets, pots and traps.**	**Hand raking (and bait collection (applicable to intertidal habitats only)**
Intertidal sand and muddy sand	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears Uncertain whether management will be required.	High energy only: No additional management required.	No additional management required.	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
Low energy intertidal sand and muddy sand		Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears		
Intertidal coarse sediment	No additional management required	No additional management required	No additional management required	No additional management required
Intertidal mixed sediment	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
Oyster bed	Oyster dredge: Uncertain whether	Uncertain whether management will	Uncertain whether management will	N/A

Feature with a conservation objective of recover that is protected by the pMCZ	Assumption for dredges (including hydraulic and tractor dredge)	Assumption for bottom trawls	Assumption for lines, nets, pots and traps.	Hand raking (and bait collection (applicable to intertidal habitats only)
	management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	
Seagrass beds	Closed to these gears	Closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
High, moderate and low infralittoral rock	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	N/A
High, moderate and low intertidal rock	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	N/A
Chalk communities	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
Peat and clay exposures	Uncertain whether management will be required.	Uncertain whether management will be required.	Uncertain whether management will be required.	Uncertain whether management will

Feature with a conservation objective of recover that is protected by the pMCZ	Assumption for dredges (including hydraulic and tractor dredge)	Assumption for bottom trawls	Assumption for lines, nets, pots and traps.	Hand raking (and bait collection (applicable to intertidal habitats only)
	Low cost scenario: no additional management. High cost scenario: closed to these gears	Low cost scenario: no additional management. High cost scenario: closed to these gears	Low cost scenario: no additional management. High cost scenario: closed to these gears	be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
Estuarine rocky habitats	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
Intertidal underboulder communities	N/A	N/A	N/A	Uncertain whether management will be required. Low cost scenario: no additional management. High cost scenario: closed to these gears
Tideswept channels	dependent on component habitats, see BSH present at site specfic level			

Joint Nature Conservation Committee and Natural England

Draft Advice

Identification of the extent to which fisheries may need restriction in MCZs

Draft Advice Marine Conservation Zones and	
Document version control	
Version 1	Date prepared 24/6/2011 Prepared by – H. Stevens Reviewed by – R. Clark
Version 2 (incorporating reviewer comments)	Date prepared 30/6/2011 Prepared by – H. Stevens Quality assured by – M. Tasker
Working Draft v3 (with added embedded spreadsheet) For review by PR Economists	Date prepared 6/7/2011 Prepared by H. Stevens & M. Tasker
(v4) Approved by:	MCZ Project Board Date Approved:

Introduction

The Statutory Nature Conservation Agencies (Natural England and the Joint Nature Conservation Committee (JNCC)) have a duty under the Marine and Coastal Access Act 2009 to provide advice and guidance to stakeholders and public authorities on the following (but not restricted to):

- How any conservation objective may be furthered or least hindered.

Requirement

The Regional Projects (RPs) need this advice to identify the likely level of restriction on fisheries required to achieve the conservation objectives for the sites, in order that the impact of any such restriction can be valued for the purposes of the Impact Assessment.

The purpose of this document and its embedded spreadsheet is to provide guidelines that can be used by the RPs, in the absence of site specific advice, to identify the likely level of restriction required, **for the purposes of Impact Assessment only.** (JNCC and Natural England have provided some initial advice on this topic within the Marine Conservation Zones fisheries advice package (1); this document provides a method to interpret this advice to identify appropriate restrictions.)

It is emphasised, however, that this document is solely a tool to identify potential restrictions under circumstances of limited evidence availability and does not reflect site specifics. **As such it should NOT be regarded as informing the level of management restriction required in practice, post-designation**. It is expected that management restrictions sought at this stage will be informed by additional evidence on the location of habitats/features, the level of sensitivity, the existing state of the feature and the

level of impact (if any). The pragmatic aspects of achieving any management restrictions, such as implementation outside territorial waters, will also require consideration at this stage. Similarly the consequences of displacement and the resultant implications for subsequent restriction need further consideration.

Using this document and the embedded spreadsheet

The advice is based on the following four potential levels of management restriction:

Extent to which fisheries may need restriction*:*

No access (prevent pressure from occurring)

Reduce (reduce level of pressure (exposure))

Restrict (limit pressure at existing levels)

Unrestricted access (no additional management)

The scenarios below indicate which of the four levels is the most appropriate to apply to any combination of fishing gear type and feature protected by an MCZ ('gear and feature combination'), to achieve the conservation objective for the feature. The embedded spreadsheet (double click on the spreadsheet to activate it, and then use the pull-down menu buttons at the top to use it) should be used to identify which gear and feature combinations from the Marine Conservation Zone advice (1) match the identified level of management restriction. The management restrictions should be identified on a site-by-site basis according to the features that are being protected and their conservation objective. The guidelines below can be followed for the identified feature to identify the potential management restriction.

Exceptions

As the MCZ fisheries advice did not provide management options for some features, some of the habitat and gear combinations will not fit the methodology laid out below, for example, sub-tidal mixed sediments. For these features, generic advice cannot be provided as the appropriate management restriction will vary in accordance with the habitat or feature that is being protected.

Scenarios:

A. Very high sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	n/a	n/a	

***Potential level of management restriction required*: No access**

Example: Seagrass bed to any demersal towed gear.

B. High sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Unrestricted access		The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	
Managed access		If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	

***Two options for the potential level of management restriction required*:**

1. For a feature with a conservation objective of 'recover': No access.[1]

Example: High, moderate and low energy circalittoral rock to high or moderate exposure of demersal towed gears.

[1] This default management measure is precautionary based on a lack of evidence regarding recoverability. It may be that for some gear/habitat combinations, in a case of moderate exposure, even for a feature with a conservation objective of 'recover', a reduction in exposure to low levels may be appropriate.

2. For a feature with a conservation objective of 'maintain': Restrict pressure.[2] (This is because the conservation objective of 'maintain' indicates that the level of exposure is already low.)

Example: Fragile sponge and anthozoan communities on sub-tidal rocky habitats to low exposure of static gears.

C. Moderately high sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Unrestricted access		This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will not be achieved under this option.	

***or* for any feature/gear combination where the following applies:**

Possible management options	Consequences to habitat/feature	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access		The conservation objective is unlikely to be met under this management option.	The conservation objective is unlikely to be met under this management option.	Medium certainty.

Two options for the potential level of management restriction required:

1. For a feature with a conservation objective of 'recover': Reduce pressure. (Exposure is reduced from moderate or high levels (as indicated by a conservation objective of 'recover') to a low level.)[3]

Example: Chalk communities to high or moderate exposure to towed demersal gear.

[2] This default management is precautionary. It reflects the **high risk of damage** by the gear types specified in JNCC & Natural England (2011) for some habitats that fall into this category. However, for some habitat/gear type combinations that fall into this broad category, there may be a lower risk of damage by the specified gear types. In this case, a management measure of 'allow' **may** be more appropriate.

[3] This default management is precautionary. It reflects the **high risk of damage** by the gear types specified in JNCC & Natural England (2011) for some habitats that fall into this category. However, for some habitat/gear type combinations that fall into this broad category, there may be a lower risk of damage by the specified gear types. In this case, a management measure of 'allow' **may** be more appropriate.

2. For a feature with a conservation objective of 'maintain': Restrict pressure.[4] (This is because the conservation objective of 'maintain' indicates that the level of exposure is already low.)

Example: maerl to static fixed gear.

D. Moderate sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Unrestricted access		This option may help to achieve the conservation objective but with risk of deterioration.	The conservation objective will not be achieved under this option.	

***or* for any feature/gear combination where the following applies:**

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Unrestricted access		This option may help to achieve the conservation objective but with a potential risk of deterioration.	The conservation objective is unlikely to be met under this management option.	

Three options for the potential level of management restriction required:

1. For a feature with a conservation objective of 'recover': Reduce pressure.[5]

Example: Intertidal mixed sediments to a high exposure to bait digging.

2. For a feature with a conservation objective of 'maintain' with moderate exposure: Restrict pressure.

Example: High moderate and low energy circalittoral rock to static gear.

3. For a feature with a conservation objective of 'maintain' with low exposure: Allow.

[4] This default management is precautionary. It reflects the **high risk of damage** by the gear types specified in JNCC & Natural England (2011) for some habitats that fall into this category. However, for some habitat/gear type combinations that fall into this broad category, there may be a lower risk of damage by the specified gear types. In this case, a management measure of 'allow' **may** be more appropriate.

[5] This is precautionary and may apply to only a few habitat/gear combinations where the risk of damage is high.

Example: Blue mussel reef to hand raking/gathering.

E. Low sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Unrestricted access		This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing pressure is very high	This option may help to achieve the conservation objective but with a potential risk of deterioration.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

Three options for the potential level of management restriction required:

1. For a feature with a conservation objective of 'recover' that has very[6] high level of exposure: Reduce pressure.[7]

2. For a feature with a conservation objective of maintain that has a high exposure: Restrict pressure.

Example: Sabellaria reef to high exposure of static gear.

3. For a feature with a conservation objective of maintain: Allow.

Example: Blue mussel reef to hand raking/gathering.

F. Lower sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	Ecological consequences of mitigation option	Compatibility with conservation objective and level of confidence in this assessment		Certainty
		Maintain	Recover	
Unrestricted access		This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective but with a potential risk of	

[6] There is no category of 'very high' as a measure of exposure in the vulnerability assessment. However, should additional information indicate a very high level of exposure, this potential management restriction can be applied.
[7] This is precautionary and may apply to only a few habitat/gear combinations where the risk of damage is high.

			deterioration	

***Or* for any feature/gear combination where the following applies:**

Possible mitigation options	**Ecological consequences of mitigation option**	**Compatibility with conservation objective and level of confidence in this assessment**		**Certainty**
		Maintain	**Recover**	
Unrestricted access.		This option may help to achieve the conservation objective	This option may help to achieve the conservation objective	

Two options for the potential level of management restriction required:

1. For a feature with a conservation objective of 'recover': Reduce pressure.[8]

Example: High energy intertidal sand to demersal towed gear.

2. For a feature with a conservation objective of 'maintain': Allow.

Example: Intertidal coarse sediment to demersal towed gear.

G. Very low sensitivity features (to pressures from fishing activities).

For any feature/gear combination where the following applies:

Possible mitigation options	**Ecological consequences of mitigation option**	**Compatibility with conservation objective and level of confidence in this assessment**		**Certainty**
		Maintain	**Recover**	
Managed access	No potential access management options were considered as impacts of these gears are minimal on this feature.	n/a	n/a	

***Potential level of management restriction required:* Allow.**

Example: coarse sediment to any static fixed gear.

Reference

[8] In practice, it will be rare for habitat types in this category to warrant a 'recover' objective, given the level of recoverability. If a 'recover' objective is identified, it is assumed that this is on the basis of strong evidence indicating the need to achieve recovery and therefore a reduction in pressure. If limited evidence is available and a 'recover' objective has been identified on a precautionary basis, a 'restrict' management option would be more appropriate.

1. JNCC & Natural England. 2011. *Advice from the Joint Nature Conservation Committee and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features*. URL: www.naturalengland.org.uk/ourwork/marine/protectandmanage/mpa/mcz/mczfurtherinformation.aspx

Annex

Broad-scale habitat type	**Gear type**	**Category for level of management restriction**
Intertidal sand and muddy sand	Dredging (including hydraulic and tractor dredge)	C
Intertidal sand and muddy sand (high energy)	All other towed demersal gear (excluding dredging)	F
Intertidal sand and muddy sand (low energy)	All other towed demersal gear (excluding dredging)	C
Intertidal sand and muddy sand	Hand raking, bait collection	D
Intertidal sand and muddy sand	All demersal static gear	G
Intertidal coarse sediment	All demersal towed gear	F
Intertidal coarse sediment	All demersal static gear	G
Intertidal mixed sediment	All demersal towed gear	C
Intertidal mixed sediment	All demersal static gear	D
Intertidal mixed sediment	Bait-digging	D
Sub-tidal sand (high energy)	All demersal towed gear	G
Sub-tidal sand (low energy including muddy sands)	All demersal towed gear	C
Sub-tidal sand	All demersal static gear	G
Sub-tidal coarse sediment (unstable)	All demersal towed gear	G
Sub-tidal coarse sediment (stable)	All demersal towed gear	C
Sub-tidal coarse sediment	All demersal static gear	G
Sub-tidal mixed sediments	All gears	Dependent on component habitats, see the component BSH [broad-scale habitat] present at site-specific level.
Sheltered muddy gravels	All gears	Dependent on component habitats, see intertidal mixed sediments and sub-tidal mixed sediments.
Sea-pen and burrowing megafauna communities	All demersal towed gear	C
Sea-pen and burrowing megafauna communities	All demersal static gear	E
Mud habitats in deep water	All gears	See sea-pen and burrowing megafauna categories.
Sub-tidal mud	All gears	See sea-pen and burrowing megafauna categories.
Deep-sea bed (without cold-water coral reef)	All demersal towed gear	C
Deep-sea bed (without cold-water coral reef)	All demersal static gear	C
Cold-water coral reefs	All demersal towed gear	A

Cold-water coral reefs	All demersal static gear	A
Maerl beds	All demersal towed gear	A
Maerl beds	All demersal static gear	C
Blue mussel beds	Mussel dredging	C
Blue mussel beds	All other towed demersal gear (excluding mussel dredging)	C
Blue mussel beds	All demersal static gear	E
Blue mussel beds	Hand collection and raking	E
Blue mussel beds	Bait collection	E
Horse mussel	All demersal towed gear	A
Horse mussel	All demersal static gear	E
Native oyster	Oyster dredge	C (although there may be site-specific differences depending on existing management regime)
Native oyster	All other towed demersal gear (excluding oyster dredge)	Dependent on component habitats, see sub-tidal mixed sediments.
Honeycomb and Ross worm reefs	All demersal towed gear	A
Honeycomb and Ross worm reefs	All demersal static gear	E
Honeycomb and Ross worm reefs	Bait collection	E
Seagrass beds	All demersal towed gear	A
Seagrass beds	All demersal static gear	C
High, moderate and low energy circalittoral rock	All demersal towed gear	B
High, moderate and low energy circalittoral rock	All demersal static gear	D
High, moderate and low energy infralittoral rock	All demersal towed gear	B
High, moderate and low energy infralittoral rock	All demersal static gear	D
High, moderate and low energy intertidal rock	All static gear, set nets	D
High, moderate and low energy intertidal rock	Hand gathering of shellfish, trampling, bait collection	E
Fragile sponge and anthozoan communities	All demersal towed gear	A
Fragile sponge and anthozoan communities	All demersal static gear	B
Chalk communities (includes littoral and sub-tidal)	All demersal towed gear	B
Chalk communities (includes littoral and sub-tidal)	All demersal static gear	D
Chalk communities (includes littoral and sub-tidal)	Hand gathering of shellfish, trampling, bait collection	D
Peat and clay exposures	All demersal towed gear	B
Peat and clay exposures	All demersal static gear	D
Peat and clay exposures	Hand gathering and bait	D

	collection	
Estuarine rocky habitats	All demersal towed gear	B
Estuarine rocky habitats	All demersal static gear	D
Intertidal under-boulder communities	Hand-gathering of shellfish and bait species	D
Tide-swept channels	All gears	Dependent on component habitats, see the component BSH [broad-scale habitat] present at site-specific level.

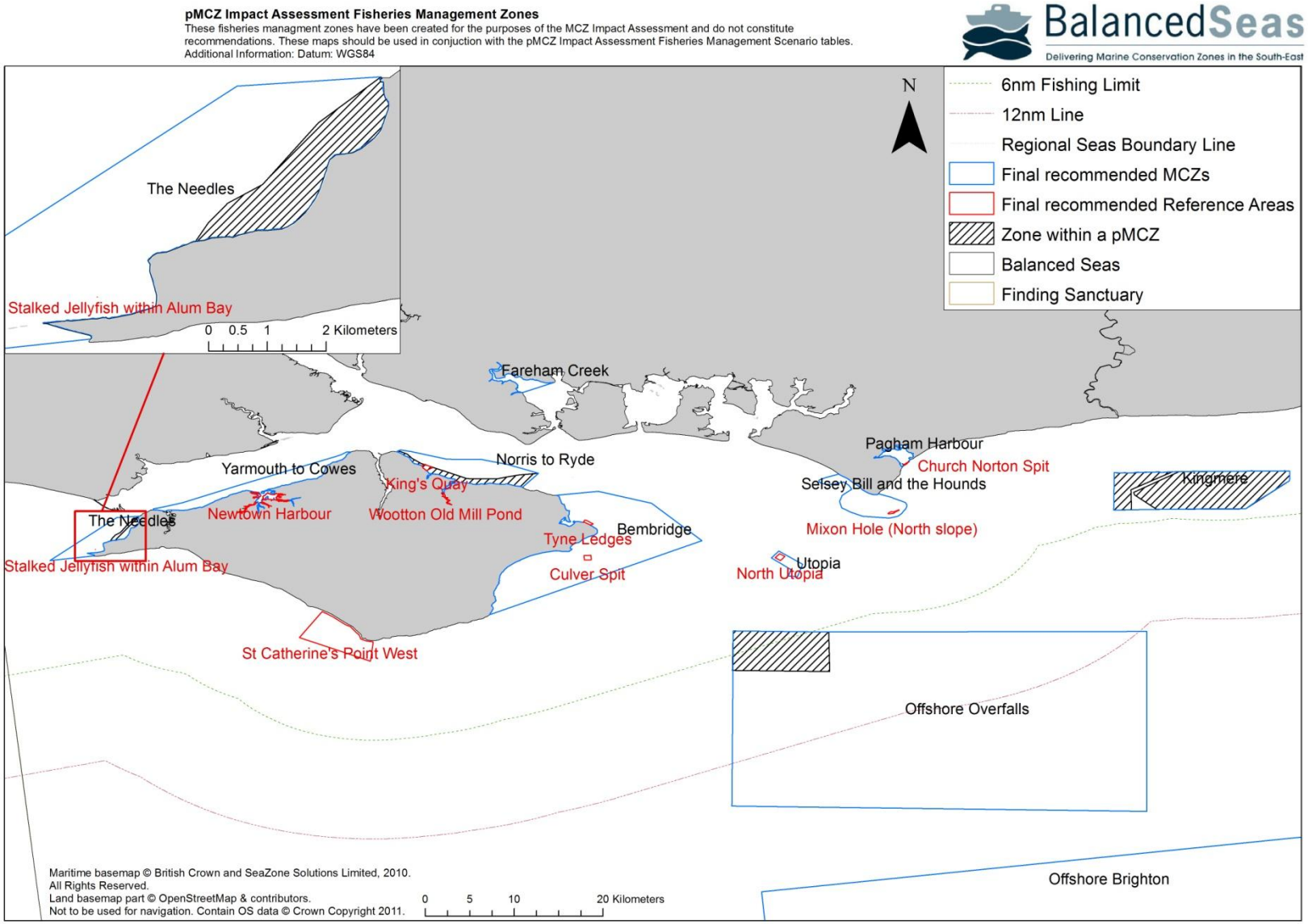
Appendix 2

Charts of rMCZs and rMCZ Reference Areas including zones for management scenarios that differ from rMCZ boundaries

Summaries and charts are set out for each regional project area in turn:

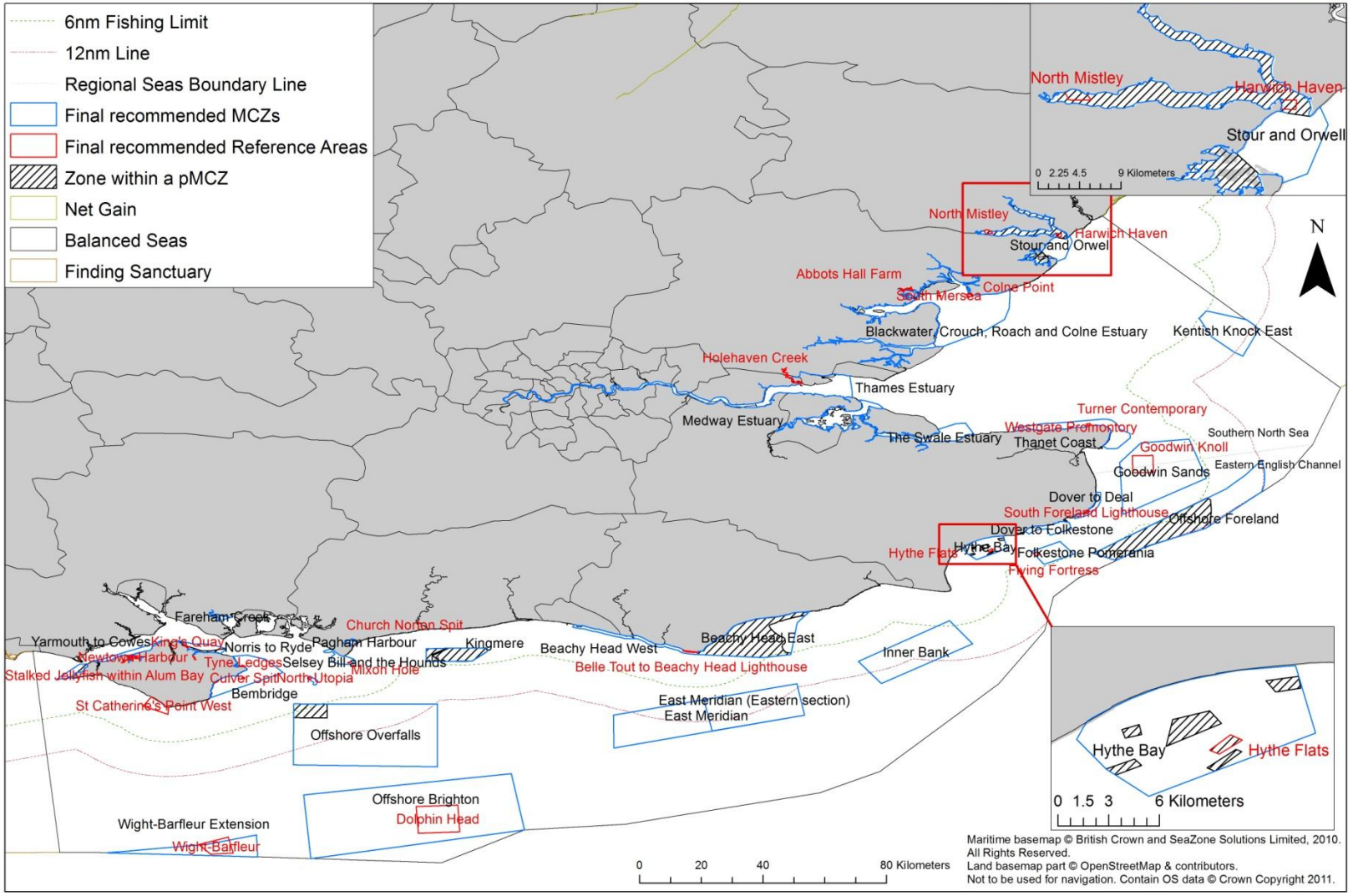
- Balanced Seas;
- Finding Sanctuary;
- ISCZ; and
- Net Gain.

Balanced Seas

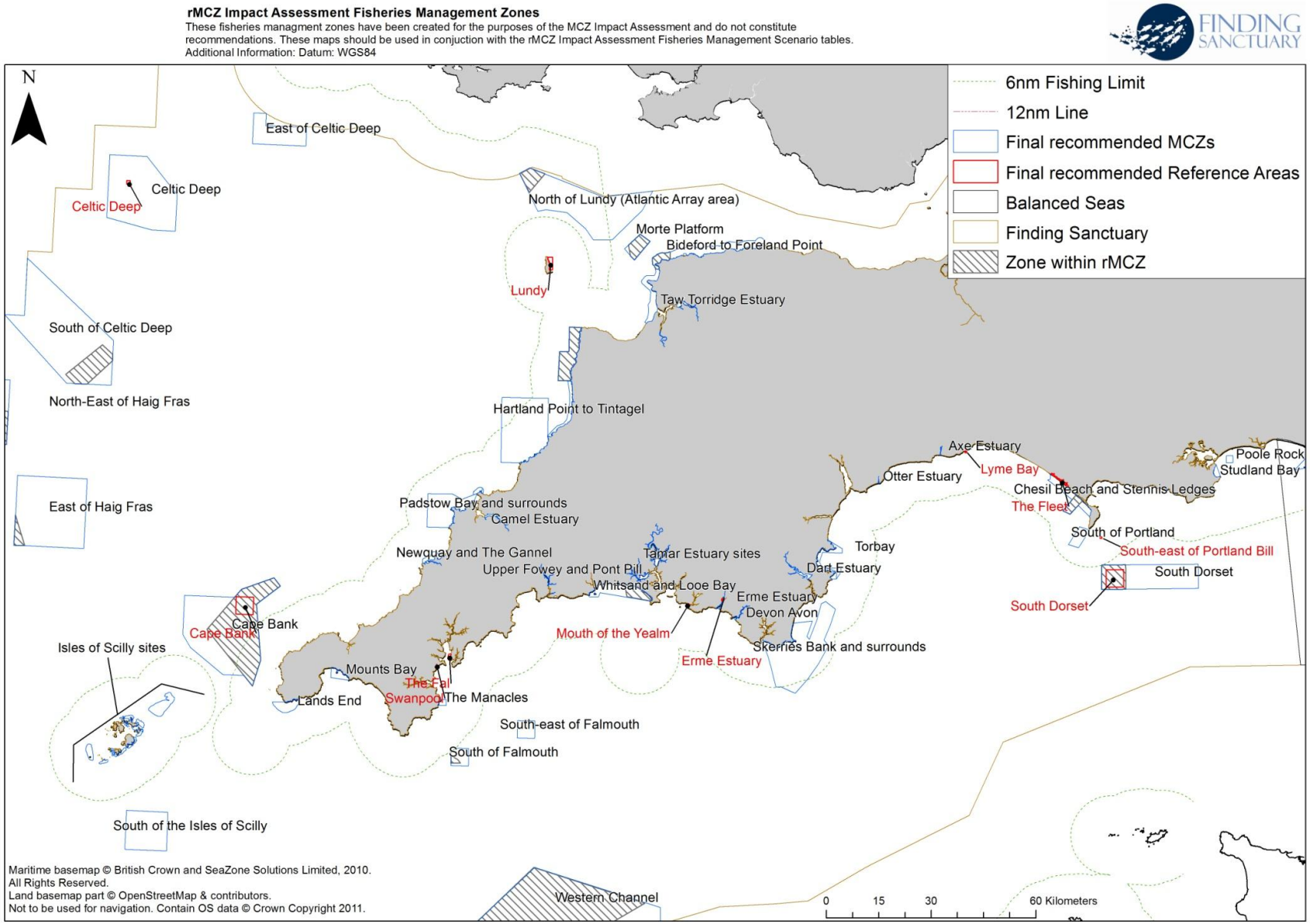


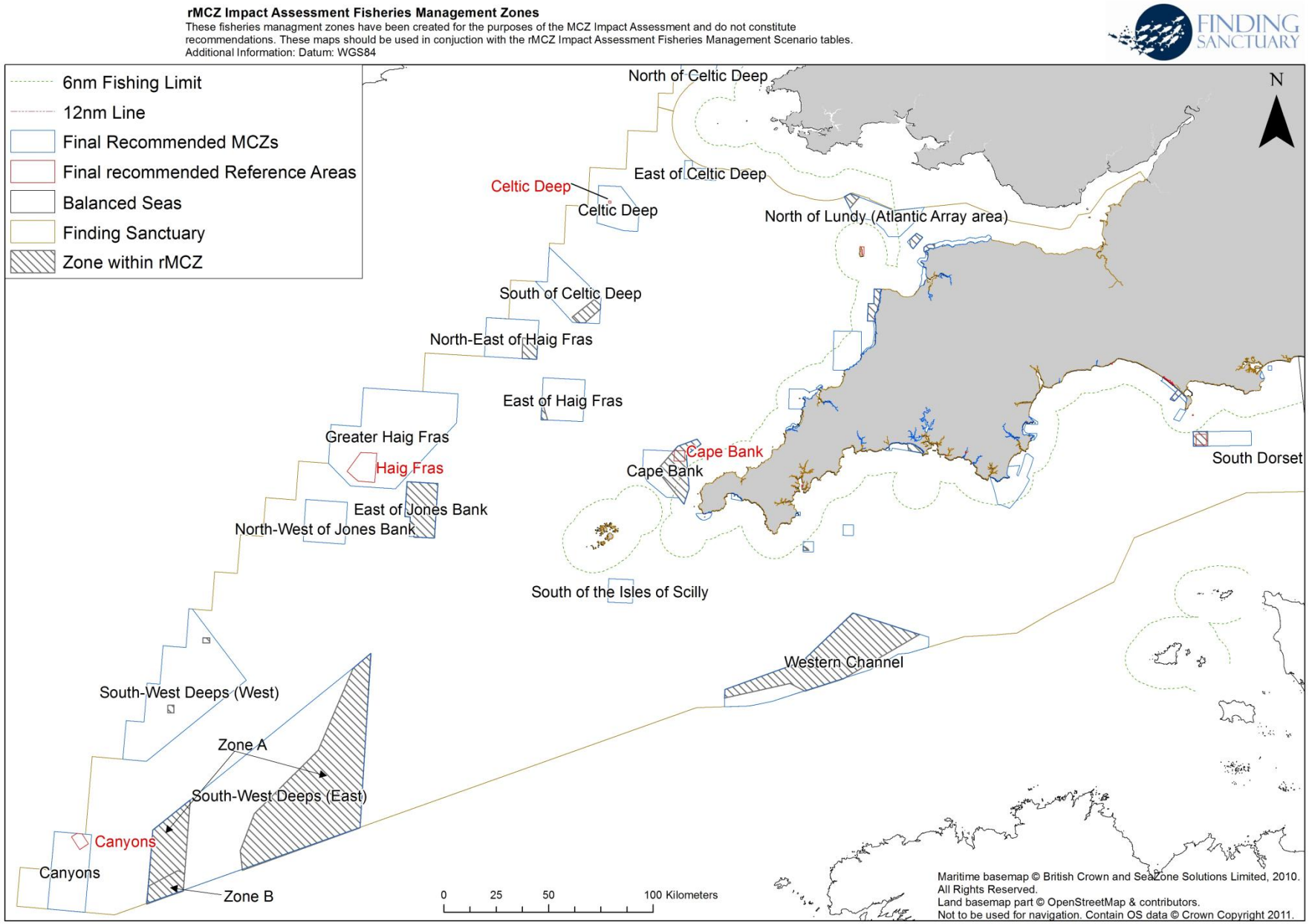
pMCZ Impact Assessment Fisheries Management Zones
These fisheries managment zones have been created for the purposes of the MCZ Impact Assessment and do not constitute recommendations. These maps should be used in conjuction with the pMCZ Impact Assessment Fisheries Management Scenario tables.
Additional Information: Datum: WGS84

BalancedSeas
Delivering Marine Conservation Zones in the South-East



Finding Sanctuary




rMCZ Impact Assessment Fisheries Management Zones
These fisheries managment zones have been created for the purposes of the MCZ Impact Assessment and do not constitute recommendations. These maps should be used in conjuction with the rMCZ Impact Assessment Fisheries Management Scenario tables.
Additional Information: Datum: WGS84
FINDING SANCTUARY
6nm Fishing Limit
12nm Line
Final Recommended MCZs
Final recommended Reference Areas
Balanced Seas
Finding Sanctuary
Zone within rMCZ
N
North of Celtic Deep
East of Celtic Deep
Celtic Deep
Celtic Deep
North of Lundy (Atlantic Array area)
South of Celtic Deep
North-East of Haig Fras
East of Haig Fras
Greater Haig Fras
Haig Fras
Cape Bank
Cape Bank
South Dorset
East of Jones Bank
North-West of Jones Bank
South of the Isles of Scilly
Western Channel
South-West Deeps (West)
Zone A
South-West Deeps (East)
Canyons
Canyons
Zone B
0
25
50
100 Kilometers
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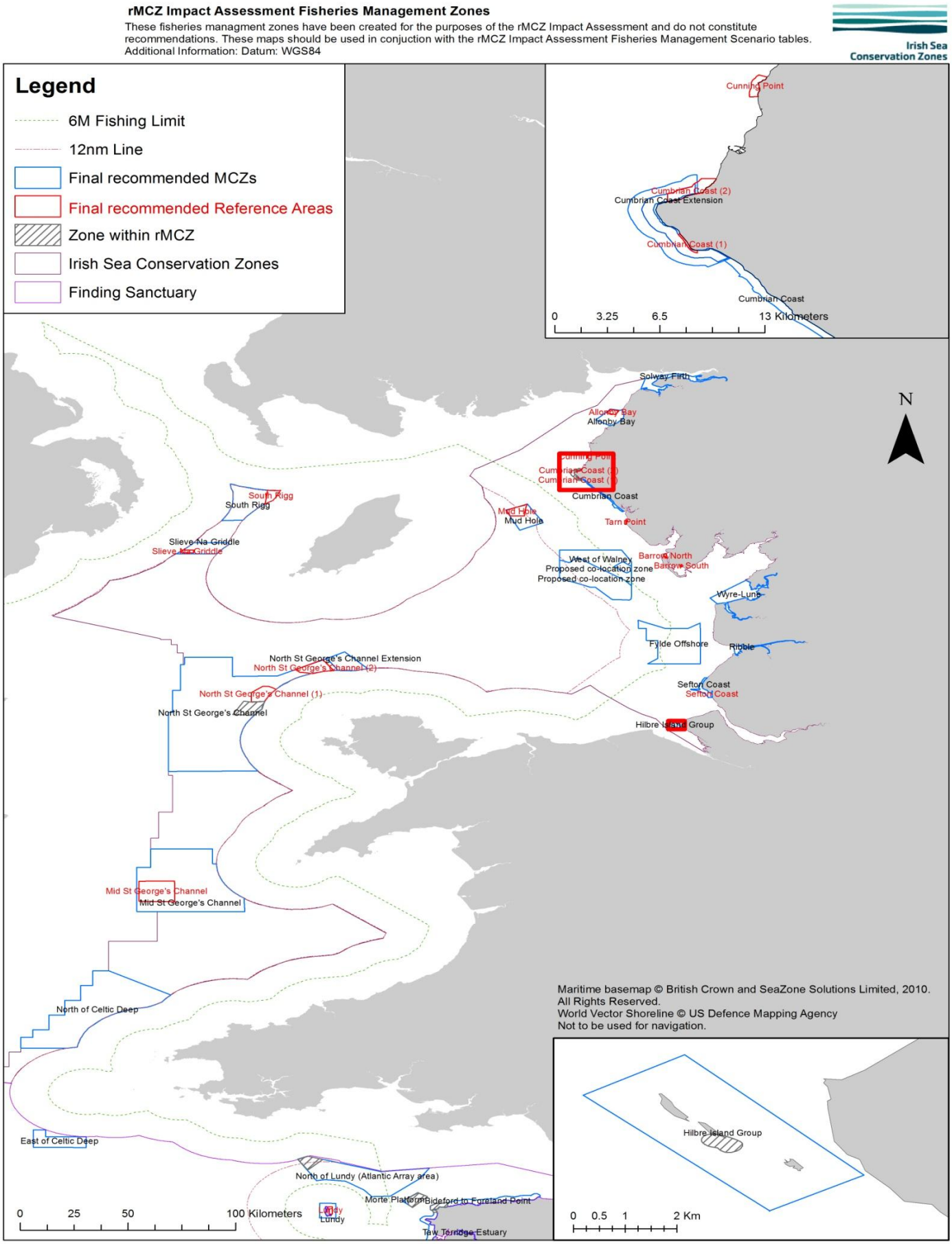
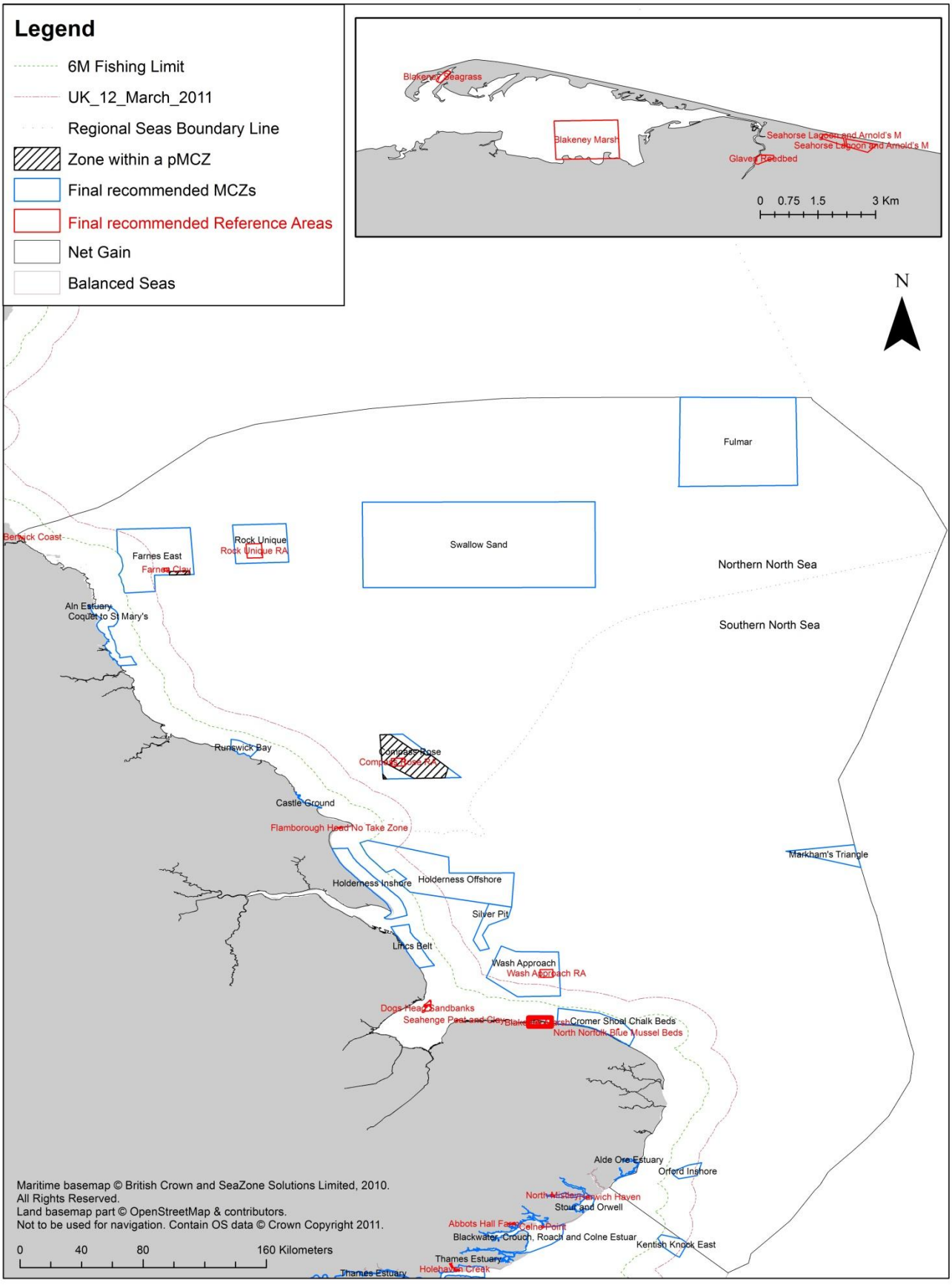
Irish Sea Conservation Zones (ISCZ)



Net Gain

pMCZ Impact Assessment Fisheries Management Zones

These fisheries managment zones have been created for the purposes of the MCZ Impact Assessment and do not constitute recommendations. These maps should be used in conjuction with the pMCZ Impact Assessment Fisheries Management Scenario tables.
Additional Information: Datum: WGS84



Appendix 3

Source of Finding Sanctuary Management Scenarios

The following table sets out the rMCZ management scenarios for commercial fishing, including the source of advice that resulted in the scenario being made. Zoned closures described in the table are shown graphically in the two charts in Appendix 2.

Black text: Finding Sanctuary-informed management scenarios (based on vulnerability assessment and management meetings carried out during the Finding Sanctuary MCZ process in April, May, June and July 2011; and Finding Sanctuary Steering Group recommendations; August 2011).
Red text: JNCC and Natural England-informed management scenarios (based on management guidance produced in November 2011).
Green text: JNCC and Natural England-informed management scenarios (based on guidance produced in March 2012).

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Axe Estuary	- No additional management				
Bideford to Foreland Point	- No additional management	- Zoned closure of area of high energy circalittoral rock in the rMCZ to bottom trawls and dredges	- Zoned closure of area of high energy circalittoral rock in the rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines
Broad Bench to Kimmeridge Bay	- No additional management				
Camel Estuary	- No additional management				
Cape Bank	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges - No removal of crawfish *Palinurus elephas* from the rMCZ	- Closure of entire rMCZ to bottom trawls, dredges - Zoned closure of area of moderate energy circalittoral rock in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Cape Bank Reference Area	- Closure of entire rMCZ to all commercial fishing apart from mid-water trawling	- Closure of entire rMCZ to all commercial fishing			
Celtic Deep	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges			
Celtic Deep Reference Area	- Closure of entire rMCZ to all commercial fishing apart from mid-water trawling	- Closure of entire rMCZ to all commercial fishing			
Chesil Beach and Stennis Ledges	- No additional management	- Zoned closure of area of high energy infralittoral rock in the rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
Dart Estuary	- No additional management				
Devon Avon	- No additional management				
East of Celtic Deep	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges			
East of Haig Fras	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of moderate energy circalittoral rock in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
East of Jones Bank	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of moderate energy circalittoral rock in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
Erme Estuary	- No additional management				
Erme Estuary Reference Area	- No additional management				
Greater Haig Fras	- No additional management	- Closure of entire rMCZ to bottom trawls & dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of moderate energy circalittoral rock and sub-tidal mixed sediment (whole site closure assumed due to interspersed nature of habitats) in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
Greater Haig Fras Reference Area	- Closure of entire rMCZ to all commercial fishing apart from mid-water trawling	- Closure of entire rMCZ to all commercial fishing			
Hartland Point to Tintagel	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges			
Isles of Scilly	- Closure of all rMCZs				

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Sites (Finding Sanctuary Steering Group Management Recommendation. Support is conditional upon this management scenario being implemented, so no other scenarios are considered)	to bottom trawls and dredges - Three-month seasonal closure (22 December to 22 March) to all commercial fishing in all rMCZs - Closure of all rMCZ to commercial sand eel fishing - Recording zone, in rMCZs: Gugh Reef - Closure of non-disturbance zones to all commercial fishing, in rMCZs: Smith Sound and Tean				
Land's End	- No additional management				
Lundy Reference Area	- No additional management				
Lyme Bay Reference Area	- Closure of rMCZ to all commercial fishing				
Morte Platform	- No additional management	- Zoned closure of areas of high and moderate energy circalittoral rock in the rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges		
Mounts Bay	- No additional management				
Mouth of the Yealm	- No additional management				
Newquay and the Gannel	- No additional management				

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
North of Lundy	- No additional management	- Zoned closure of areas of moderate energy circalittoral rock in the rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges		
North-East of Haig Fras	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of sub-tidal mixed sediment in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
North-West of Jones Bank	- No additional management	- Closure of rMCZ to bottom trawls & dredges			
Otter Estuary	- No additional management				
Padstow Bay and Surrounds	- No additional management	- No removal of crawfish *Palinurus elephas* from the rMCZ			
Poole Rocks	- No additional management				
Skerries Bank and Surrounds (Finding Sanctuary Steering Group Management Recommendation. Support is conditional upon this management scenario being implemented, so no other scenarios are	- No additional management: continuation of the Inshore Potting Agreement management regime				

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
considered)					
South Dorset	- No additional management	- Zoned closure of areas of high energy circalittoral rock and moderate energy circalittoral rock in the rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
South Dorset Reference Area	- Closure of entire rMCZ to all commercial fishing apart from mid-water trawling	- Closure of entire rMCZ to all commercial fishing			
South of Celtic Deep	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of sub-tidal mixed sediment in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
South of Falmouth	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of moderate energy circalittoral rock in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
South of the Isles of Scilly	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges			
South of Portland	- No additional management				

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
South-East of Falmouth	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges			
South-East Portland Bill Reference Area	- Closure of entire rMCZ to all commercial fishing				
South-West Deeps (East)	- No additional management	- Zoned closure of area of deep-sea bed and sub-tidal coarse sediment in the rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of deep-sea bed in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
South-West Deeps (West)	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of sub-tidal mixed sediment in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Studland Bay	- Zoned closure of seagrass beds in the rMCZ to dredges and bottom trawls	- Zoned closure of seagrass beds in the rMCZ to dredges, bottom trawls, pots & traps, nets, lines, hand collection	- Closure of entire rMCZ to dredges, bottom trawls, pots & traps, nets, lines, hand collection		
Swanpool Reference Area	- No additional management				
Tamar Estuary Sites	- No additional management				
Taw Torridge Estuary	- No additional management				
The Canyons	- Zoned closure of area of cold-water coral reefs in the rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of area of cold-water coral reefs in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines		
The Canyons Reference Area	- Closure of entire rMCZ to all commercial fishing apart from mid-water trawling	- Closure of entire rMCZ to all commercial fishing			
The Fal Reference Area	- Closure of entire rMCZ to all commercial fishing				
The Fleet Reference Area	- Closure of entire rMCZ to all commercial fishing				
The Manacles	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges - No removal of crawfish *Palinurus*			

rMCZ name	Scenario 1: Lowest cost	Scenario 2	Scenario 3	Scenario 4	Scenario 5
		elephas from the rMCZ			
Torbay	- Zoned closure of seagrass beds in the rMCZ to dredges and bottom trawls	- Zoned closure of seagrass beds in the rMCZ to dredges, bottom trawls, pots & traps, nets, lines, hand collection	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges, pots & traps, nets, hooks & lines	
Upper Fowey and Pont Pill	- No additional management				
Western Channel	- No additional management	- Closure of entire rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges - Zoned closure of areas of moderate energy circalittoral rock and sub-tidal mixed sediment in the rMCZ to pots & traps, nets, hooks & lines	- Closure of entire rMCZ to bottom trawls, dredges, pots & traps, nets, hooks & lines	
Whitsand and Looe Bay	- No additional management	- Zoned closure of areas of sea fan anemone *Amphianthus dohrnii*, Icelandic cyprine *Arctica islandica*, pink sea fan *Eunicalle verrucosa*, giant goby *Gobius cobitis*, stalked jellyfish *Haliclystus auricular* and long-snouted seahorse *hippocampus guttulatus* in the rMCZ to bottom trawls and dredges	- Closure of entire rMCZ to bottom trawls and dredges		