Annex H5 Method for assessing benefits

Contents

H5.1 This annex outlines the method taken to assess the potential benefits created by the designation of recommended Marine Conservation Zones (rMCZs). The assessment considers the primary benefits to conservation as well as potential impacts on the delivery of ecosystem services.

1 Policy origin and purpose

H5.2 A review of the origin of the UK government's policies concerning Marine Conservation Zones (MCZs) and Marine Protected Areas (MPAs) was undertaken by Natural England in order to provide the policy context. The review summarises the key international and national drivers and the anticipated benefits of these policies. This review is set out in Appendix 2 of Annex L.

2 Benefits to conservation

H5.3 The aim of creating an ecologically coherent network of MPAs, to which MCZs make a significant contribution, is to protect marine flora and fauna (particularly species that are rare or threatened), marine habitats and types of marine habitat, and features of geological and geomorphological interest (JNCC & Natural England, 2010).

H5.4 The discussion of potential benefits of MCZs in Annex L sets out the need for conservation of each of the features proposed for protection, based on information provided in the Ecological Network Guidance (ENG) (JNCC and Natural England, 2010). The coverage of individual habitats and species (in terms of the area covered or the number of records) within each rMCZ is set out for each regional MCZ project area in Annex B. The information is sourced from the regional MCZ project final recommendations reports (Balanced Seas (2011), Lieberknecht and others (2011), Net Gain (2011), ISCZ (2011)).

H5.5 An overview of the benefits of an ecologically coherent network are set out in Annex L, along with the ENG principles followed during the planning of rMCZ locations, which should ensure the ecological coherence of the network.

3 Ecosystem services framework

H5.6 The framework used to assess beneficial impacts on ecosystem services in Annex L of the impact assessment (IA) is based on that provided in *An introductory guide to valuing ecosystem services* (Defra, 2007).[1] Assessments of ecosystem services are considered by the Department for Environment, Food and Rural Affairs (Defra) to provide a particularly suitable framework within which to account for environmental change. An ecosystem services framework has been combined with the Total Economic Value (TEV) framework to ensure that both use and non-use values are captured.

H5.7 The ecosystem service classification used in this IA was adapted from the classifications used in the Millennium Ecosystem Assessment (MA, 2005) and The Economics of Ecosystems and Biodiversity (TEEB) initiative (Balmford and Others, 2008)[2]. Adaptations to the classifications were carried out by Fletcher and others (2012) in order to tailor the classification to the marine

[1] Further discussion on the concept and definition of ecosystem services is not repeated here.
[2] http://www.teebweb.org/

environment and to ensure that only services reliant on active marine processes were included. They identify ecosystem services based on the following:

- **Core ecosystem processes:** these describe the basic ecosystem processes supporting ecosystem functions.
- **Beneficial ecosystem processes:** these are the specific ecosystem processes that directly underpin benefits to people.
- **Beneficial ecosystem services:** these are the products of ecosystem processes that directly impact human wellbeing.

H5.8 A detailed classification of core ecosystem processes, beneficial ecosystem processes and beneficial ecosystem services used by Fletcher and others (2012) is presented in Appendix 1 to this annex. This assessment considers groups of these ecosystem services, as set out in Table 1.

H5.9 It is acknowledged that, were economic valuation applied to the above ecosystem services, there is likely to some double counting of some ecosystem services. Fisher, Turner and Morling (2009) discuss the potential for double counting when using the MA classification in cost-benefit analysis for environmental decision-making. They suggest that a more appropriate classification, which would avoid double counting when undertaking economic valuation, should divide ecosystem services into intermediate services, final services and benefits. As this IA does not attempt to value all changes in ecosystem services (as discussed later in the annex), the looser classification of ecosystem services set out in Table 1 has been retained. This enables the general narrative on the potential beneficial changes in ecosystem service delivered to consider a broad range of evidence, where otherwise limitations in the evidence base may result in a reduced discussion of benefits.

H5.10 Given this approach, it should be recognised that the ecosystem service benefits discussed in this IA would, if valued and summed, potentially result in an overestimate due to double counting. To aid the transparency of the assessment, the ecosystem services classification set out in Table 1 includes information on whether the service is thought to be an intermediate service, final service or good, based on the framework set out in the UK National Ecosystem Assessment (2011). Final ecosystem services directly contribute to the goods that are valued by people whereas intermediate ecosystem services underpin the final ecosystem services, but are not directly linked to goods (National Ecosystem Assessment, 2011). Goods are 'good things', the presence of which yields wellbeing in people (and the absence lowers well-being) (National Ecosystem Assessment, 2011). If future analysis seeks to undertaken economic valuation of the changes in ecosystem services resulting from MCZs, then care should be taken to ensure that the approach does not result in double counting.

Table 1: Ecosystem service groups

General ecosystem service categorisation	Ecosystem services used in the IA	Type of service
Provisioning	Provision of fish and shellfish for human consumption	Final ecosystem service*
Cultural	Recreation	Goods
	Research and education	Final ecosystem service
	Non-use	Goods
Regulating	Natural hazard protection	Final ecosystem service
	Environmental resilience	Intermediate ecosystem service
	Gas and climate regulation	Final ecosystem service
	Regulation of pollution	Final ecosystem service

* Provision of fish and shellfish for human consumption is considered to be a final service as the good that is valued by people is food which is produced from the fish and shellfish.

H5.11 Definitions of these services are provided below under the general categories of provisioning, cultural and regulating services, informed by Beaumont and others (2006):

Provisioning services

- Provision of fish and shellfish for human consumption: harvesting of wild fish, crustaceans (such as crabs and lobsters) and other shellfish (such as scallops, oysters and mussels) for people to eat.

Cultural services

- Recreation and leisure: A wide range of recreational activities are based on marine habitats and species including rock pooling, some beachcombing, watching seabirds and marine mammals, recreational angling, and some recreational diving. Some of these also create local employment. Participants of other recreational activities that are based in the coastal and marine environment, such as walking and sailing, also have an improved experience as a result of marine habitats and species.

- Research and education: Some marine organisms have informed the development of medicines and technology and others may do so in future. Research and monitoring provide insights into how the marine environment has changed in the past and continues to change. The marine environment is an important component of education in the UK, for the public and students of all ages.

- Non-use: Some people derive benefit from the knowledge that the natural environment is being conserved. There are three main components:
  - Bequest value: where individuals attach value to the fact that the ecosystem resource will be passed on to future generations.
  - Altruistic value: where individuals attach value to the availability of the ecosystem resource to others in the current generation.

- Existence value: derived from the existence of an ecosystem resource, even though an individual has no actual or planned use of it .

Regulating services

- Environmental resilience: The extent to which ecosystems can absorb recurrent natural and human perturbations and continue to regenerate without slowly degrading or unexpectedly flipping to alternate states.

- Natural hazard protection: some habitats and species can dampen and prevent environmental disturbances in coastal regions, such as damage to physical assets (natural and man-made) caused by tides, storms and flooding.

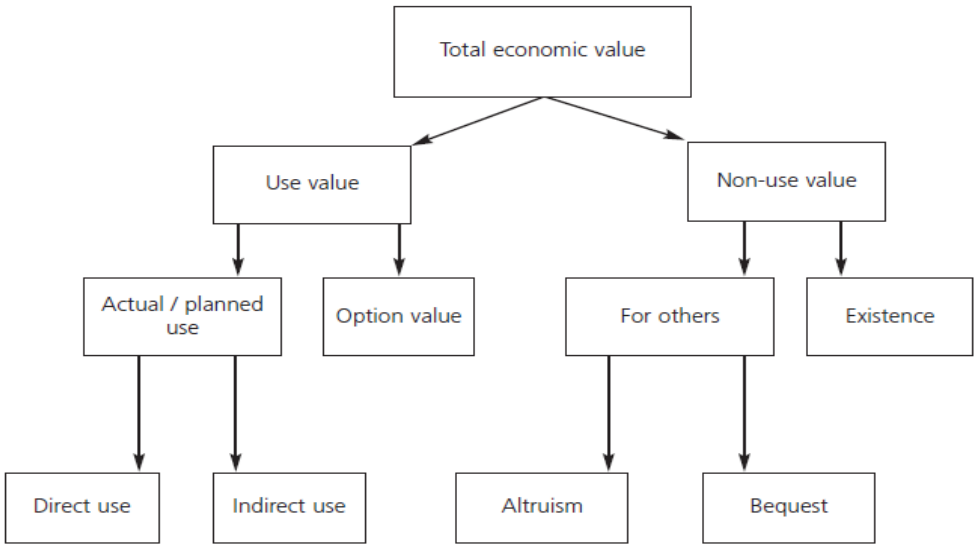
- Regulation of pollution: marine organisms contribute to the storage, dilution, transformation and burial of anthropogenic waste, providing detoxification and purification of water.

- Gas and climate regulation: balance and maintenance of the chemical composition of the atmosphere and oceans by marine-living organisms.

H5.12 Ecosystem services that involve extraction of MCZ features or that only impact negatively on the condition of the features are not included in the assessment of benefits of MCZs for the IA. This is because they will not benefit from the additional management for MCZs. The following services considered by Fletcher and others (2012) fall in to this category: provision of fertiliser, feed, salt, ornamental materials, biofuels, medicines, materials for aquaria and provision of habitat, spat or stock for aquaculture. Where provision of these services will be negatively impacted by the additional management for rMCZs, the costs have been assessed in Annex I.

H5.13 The assessment of impacts on ecosystem services was carried out within the total economic value (TEV) framework, and as such incorporates both use and non-use values (see Figure 1). TEV allows the total gain in society's wellbeing from a policy to be captured (Defra, 2007). Definitions of each of the components of TEV can be found in (Defra, 2007).

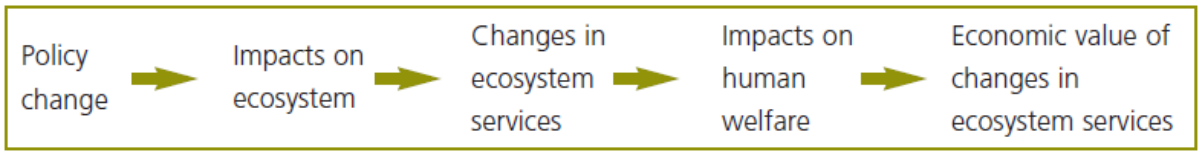
Figure 1: TEV framework



Source: Defra, 2007

H5.14 The assessment of impacts on ecosystem services employed in the IA is based on the impact pathway approach (Defra, 2007). This focuses on the marginal change in ecosystem services that results from MCZ designation (and management) (see Figure 2).

Figure 2: Overview of impact pathway of policy change



Source: Defra, 2007

4 Assessment of ecosystem service benefits of the entire suite of MCZs

H5.15 This section sets out the method used to assess the potential benefits of the suite of MCZs on ecosystem services, the outputs of which are set out in the Evidence Base and Annex L. It provides details of a literature review (Fletcher and others, 2012) undertaken to establish the ecosystem services potentially provided by the features listed in the ENG; the method by which underlying changes in feature condition were assessed in the IA; and details of the approach taken to assess changes in ecosystem service provision.

4.1 Ecosystem services provided by MCZ features

H5.16 A literature review (Fletcher and others, 2012) was commissioned by JNCC and Natural England to inform the baseline for the assessment of impacts on ecosystem services in the IA for MCZs. This reviewed available evidence on the contributions made to marine ecosystem processes and services by the broad-scale habitats and features (habitats and species) of conservation importance (FOCI) that are likely to be protected by MCZs (as defined in the ENG) .

H5.17 A summary of the review's findings is presented in Annex L. This indicates the range of ecosystem services to which the broad-scale habitats and FOCI contribute and the strength of the evidence identified in the review. It was found that the strength of evidence varied considerably, making any conclusions on the ecosystem services provided by broad-scale habitats and FOCI extremely tentative (Fletcher and others, 2012).

H5.18 The authors employed three broad categories of evidence to inform the review: peer-reviewed literature, grey literature and expert opinion. Evidence directly related to the UK was prioritised in the searches but, where this was not available or limited in scope, research from comparable temperate environments was sought.

4.2 Impacts of MCZs on ecosystems

H5.19 The IA's assessment of impacts of MCZs on ecosystem services is informed by the impacts of MCZs on the condition of MCZ features. Once designated, appropriate management of the sites will reduce the risk that the extent, population, structure, natural environmental quality and processes of the features protected by MCZs will diminish over time. This is because, if a site is not designated or appropriately managed, there is a risk that the features will be adversely

affected by human activities. In addition, if the sites are not designated there is a risk that new human activities and changes to existing activities could have an adverse effect on the habitats and species. In the absence of MCZs, it may also be more difficult to ensure that effective additional mitigation is provided where it is required through the consenting of activities. The potential impacts of human activities on features recommended for protection by MCZs are presented in JNCC and Natural England (2011a and b) and are summarised for commercial fishing in Annex H7. Annex G summarises the potential impacts of MCZs on information provision and decisions regarding marine licence applications.

H5.20 In the absence of information on the anticipated trends in condition of MCZ features in the absence of MCZs (the baseline), it is assumed that their baseline condition will hold constant over the 20 year period of the IA. The likely baseline condition of rMCZ broad-scale habitats and FOCI was established through a series of assessments of the vulnerability of the features to anthropogenic pressures. The Vulnerability assessments were desktop assessments carried out by the regional MCZ projects between March and June 2011. The assessments were undertaken based on guidance on establishing conservation objectives (JNCC and Natural England, 2011c) and a series of activity-pressure-features matrices provided by Natural England and JNCC. For the vast majority of rMCZs, no survey evidence was available to inform the vulnerability assessment process. As such, there is significant uncertainty in the defined baseline condition. Further detail on the vulnerability assessment process can be found in the regional MCZ project recommendation reports (Balanced Seas (2011), Lieberknecht and others (2011), Net Gain (2011), ISCZ (2011)).

H5.21 In the absence of more detailed information, the IA assumes that the expected change in feature condition that will arise as a result of MCZ designation and management is defined qualitatively by its draft conservation objective. For rMCZs that are not rMCZ Reference Areas, the draft conservation objective can be one of either:

- recover to favourable condition. Features assessed to be in unfavourable conditions were assigned draft conservation objectives of 'recover to favourable condition' (through vulnerability assessments undertaken by the regional MCZ projects). The IA assumes that with MCZ designation and appropriate management, the draft conservation objectives will be met and that the feature(s) will recover to favourable condition over time. In summary, a feature will attain favourable condition when its extent or population is stable or increasing, when it has the structure and functions (or habitat) that are necessary for its long-term maintenance, and when the quality and occurrence of habitats and the composition and abundance of species are in line with prevailing natural conditions (Natural England and JNCC, 2011).
- maintain at favourable condition. Features assessed to be in favourable conditions were assigned draft conservation objectives 'maintain at favourable condition' (through vulnerability assessments undertaken by the regional MCZ projects). The IA assumes that as a result of MCZ designation and continued appropriate management, the draft conservation objectives will be met and the feature(s) will be maintained in favourable condition. The MCZ designation and continued appropriate management will protect the features against the risk of degradation from pressures from human activities in the future (that are not currently known). Though it is assumed that, in

most cases, mitigation of the impacts of human activities is not currently required, mitigation would, if necessary, be introduced (with the associated costs and benefits);

H5.22 For rMCZ Reference Areas, the draft conservation objective is always:

- recover to reference condition. Vulnerability assessments were not undertaken for rMCZ reference areas, as it is assumed that no rMCZ features are likely to be in reference condition. All rMCZ reference area features therefore have conservation objectives of 'recover to reference condition'. Where an rMCZ reference area is situated within a normal rMCZ, the baseline conditions of the features in the rMCZ reference area are assumed to be as described for the normal rMCZ (as described in the vulnerability assessment for the normal rMCZ). Where rMCZ reference areas are not situated within normal rMCZs, and hence no information on the baseline conditions of features is available from vulnerability assessments, the IA assumes that features with a conservation objective of 'recover to reference condition' are currently 'not in reference condition'. The IA assumes that, with MCZ designation and appropriate management, site features will recover to reference condition over time. Reference condition is the state where there are no, or only very minor, changes to the values of the hydromorphological, physio-chemical and biological quality elements which would be found in the absence of anthropogenic disturbance (Natural England and JNCC, 2011).

H5.23 Vulnerability assessments were not carried out for features in rMCZ Reference Areas, as it is assumed that no features are currently in reference condition.

H5.24 It is not possible to quantitatively assess the impact of MCZs on feature condition for a number of reasons. The definitions of feature condition are qualitative, and as such are open to interpretation. There is uncertainty about feature condition in the baseline. Further difficulties in assessing the impacts of MCZs arise from the uncertainty in ecosystem functioning which arises from its complexity, the lack of defining barriers and transient nature of the marine environment (e.g. species are not restricted the boundaries of an MCZ). The only assessment that is feasible for the IA is a qualitative description of the change in condition of MCZ features relative to the baseline.

4.3 Impacts of MCZs on ecosystem services

H5.25 This section summarises the challenges in assessing the impacts of MCZs on ecosystem services and the main sources of information that were used to inform this assessment for the IA (further details are provided in Annex L).

H5.26 It was not feasible to value the impacts of MCZs on ecosystem services. Reasons for this are as follows. Collecting the necessary data would be a significant undertaking that would identify large numbers of inconsistencies and gaps that would limit the usefulness of any outputs. The data that would be required would include links between the different MCZ habitats, species and wider ecosystems, the impact of the potential management scenarios on anthropogenic pressures, feature condition, ecosystem processes and services and the effects of site specific factors (such as site area and depth of water column). This would be required for the large number of features recommended for protection by the suite of rMCZs, which include: 23 broad-scale habitat types (which cover the full range of habitat types in the MCZ project area), 22 habitats of conservation

importance, 32 species of conservation importance, and a small number of other habitats and species. Knowledge of many of these habitats and species is limited, dispersed and in disparate forms, as indicated by Fletcher and others (2012). If impacts of MCZs could be quantified, appropriate approaches for valuation would need to be used, which would differ between ecosystem services.

H5.27 As part of the development of the Evidence Base for the Marine and Coastal Access Act (2009), primary valuation work was carried out to illicit use and non-use values[3] for a hypothetical network of MCZs and MPAs (based on a willingness-to-pay (WTP) survey[4]). While the potential network is now better defined and understood, the significant uncertainties and lack of specific information on the features and their current and future condition limits the usefulness of carrying out another willingness-to-pay survey (the costs of which would be significant).

H5.28 The assessment of benefits provided in the IA is informed by a review of key evidence of ecosystem service benefits that arise from additional management of human activities in the marine environment that is similar to that employed in the management scenarios for the IA. Based on this review, tentative indications of the impacts of MCZs on ecosystem services are inferred. The review was carried out for the groups of ecosystem services defined earlier in Table 1. It concentrates on evidence of potential changes in the delivery of ecosystem services, but also provides information on potential changes in ecosystem processes and ecosystem service values, where appropriate. The value data presented includes both supply side and demand side values, which are not strictly comparable and as such should not be aggregated. The purpose of this section is to provide illustrative information on the potential benefits where the literature provide appropriate evidence, rather than deliver a aggregated benefits figure. The necessary data were not available in the literature of for MCZs (as described above) for quantitative analysis of impacts of MCZs on ecosystem services to be carried out.

H5.29 In addition to a review of available evidence, the following data collection exercises were carried out to contribute to the assessment of potential recreation benefits:

- Data collection from European Marine Site (marine Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)) (EMS) managers: Ten managers of EMSs were interviewed by the regional MCZ project teams and asked whether marine SACs and SPAs had led to any recreation benefits or changes in recreation activities. The site managers were asked whether changes in visit rates, types of recreation activities, and quality of the recreation experience had arisen that could be attributed to the designation of the sites (and any associated changes in site management and ecological improvements). The findings are reported in Annex L.
- Recreation and tourism surveys: Approximately 150 recreation stakeholders were contacted by the regional MCZ project teams by email and telephone to gather their perceptions of potential benefits to leisure and recreation of MCZs. The stakeholders included members of voluntary and statutory nature groups, and staff working in coastal partnerships, local authorities, place promotion bodies and tourist information centres. The response rate was very low, less than

[3] Described further in Annex L.
[4] Further information on willingness-to-pay surveys can be found in Defra (2007)

10%, and a number of those who did respond said that they did not have enough knowledge of the likely impact of MCZs on which to make an informed opinion.

5 Site-level assessments

H5.30 This section sets out the method employed at the site-level to assess the potential benefits. This includes the ecological benefits and impacts on ecosystem services. The outputs from this are set out in Annex I.

5.1 Ecological descriptions

H5.31 Ecological descriptions have been provided for each site, presented in Table 1 for each rMCZ in Annex I. The descriptions provide, where possible, a qualitative summary that highlights the key ecological characteristics of each site and environmentally important features. For some sites, most notably many of those in offshore areas, there is limited existing verified evidence on which to base the descriptions.

H5.32 These summaries are based on descriptions that were developed for the Selection Assessment Documents (SADs) compiled for the regional MCZ projects' final recommendations. The descriptions include information provided through stakeholder meetings, expert opinion and found in publications, including existing scientific literature and documentation collected by the projects, which provides justification for the recommendation of the site.

5.2 Impacts on the ecological condition of features in the sites

H5.33 The IA provides a qualitative indication of the baseline condition, and the potential impact of MCZs on the condition, of the features recommended for protection in each site. This is presented in Table 1 for each rMCZ in Annex I. The assessment is based on the outputs of vulnerability assessments carried out by the regional MCZ projects (as explained in the earlier section on 'Impacts on ecosystems'). In the absence of appropriate evidence on which to base a dynamic baseline assessment, it is assumed that the baseline condition identified will hold constant over the 20 year period of the IA.

H5.34 It is assumed that appropriate management will reduce damaging anthropogenic pressures and reduce the risk that the extent, population, structure, natural environmental quality and processes of the features protected by MCZs will diminish over time. As such, for the purposes of the IA it is assumed that, once designated, appropriate management of the sites will allow the conservation objectives to be met.

H5.35 Quantitative indicators of impact are limited to the number of instances, habitat area and/or number of scientific records to which a conservation objective for an individual feature applies (which are listed in Table 1 for each rMCZ in Annex I).

5.3 Contribution to an MPA network

H5.36 Natural England and JNCC will provide advice to Defra on how the features of each rMCZ contribute to the ENG guidelines at the regional MCZ project area and wider scale.[5] This information was not available at the time of writing this IA so has not been included.

5.4 Ecosystem services

H5.37 Limited evidence is available on the baseline value of ecosystem services provided in each rMCZ. In the absence of better information, a general statement on the quality and quality of each ecosystem service provides in each rMCZ has been set out. This identifies that the quantity and quality provided by the features of the site will be commensurate with their condition. That is, the quantity and quality provided by the features when in unfavourable, favourable or reference condition. Where possible, further site specific information has also been provided. This futher information includes:

- Fish and shellfish provision for human consumption: a description of commercial fisheries within the site and the value of commercial fisheries landings, using market prices. Estimates of the value are taken from the MCZ Fisheries Model;

- Recreation: a description of the activities and the number of people participating in those activities;

- Research and education: a description of the types of research and recreation activitites occur in the site;

- Regulating services: no further information

- Non-use values: no further information

H5.38 In order to understand the likely impacts of MCZs on ecosystem services, we need to know the management regime and information on the current and expected habitat condition, as well as the interactions between changes in human activities, feature condition and the wider ecosystem that deliver ecosystem services. Given the significant data requirements and uncertainties, conducting separate primary valuation work for each individual rMCZ was not possible (explanation is provided above as to why it was not possible for the suite of rMCZs). In explanation, recommendations have been made for 108 rMCZs, and a further 65 rMCZ Reference Areas that offer a higher level of protection have been recommended, protecting over 1,000 instances of particular habitats and species.

H5.39 Given the limited evidence on which to base an assessment, a number of key factors have been identified from the review of evidence (see Annex L) which have been used to describe the potential for MCZs to provide site-specific benefits to ecosystem services. This is a simple assessment approach which does not recognise the complexity of all influencing factors and their

[5] Due for publication in July 2012.

interactions. This may result in potential beneficial impacts at the site level being over or understated, and aspects of beneficial impacts potentially not being considered.

H5.40 The 'Your Seas Your Voice' (YSYV) campaign, which the Marine Conservation Society (MCZ) ran through its website, identified reasons why people would like specific areas of the marine environment to be conserved by protected areas[6] (Ranger and others, 2012). Reasons provided by participants reflected a range of potential non-use sentiment. For relevant rMCZs, examples of these non-use sentiments have been included.

H5.41 The uncertainty involved in any such assessment, no matter how detailed, should be recognised and the outcomes of this assessment should, in general, be treated with low to moderate confidence. Despite this, the coverage of this assessment is considered to be proportionate given the information and resource constraints, and to provide sufficient information to contribute usefully to designation decisions.

H5.42 Table 4s in Annex I present the site-level assessments for each ecosystem service category (outlined in Table 1) for each rMCZ. 'Recreation' is considered under the following categories: angling, diving and wildlife watching. It should be noted that in the Balanced Seas region a further category was used: 'other recreation'. All of the regional MCZ projects have provided assessments of beneficial impacts on angling, diving and wildlife watching where such benefits may arise. In addition, Balanced Seas has provided an assessment of beneficial impacts on 'other recreation' which presents qualitative information where available on other recreational activities and tourism that take place within rMCZs or on the adjacent coast. As there is little evidence of the beneficial impact on such other recreational activities of designating locations as protected areas, this assessment in the Balanced Seas project area has been recorded as low confidence and has not been undertaken by the other regional projects.

H5.43 The Table 4s present a qualitative description of the baseline situation and the potential impact on beneficial ecosystem services. The qualitative assessment of the potential impact is

[6] The YSYV campaign was run through an interactive website. Using a Google mapping function visitors were able to '*nominate their own'* sites for protection and were also given an opportunity to provide qualitative data about the person's relationship with the sea and their reasons for wanting the site to be protected. Visitors could alternatively vote for a site out of the 73 '*MCS Recommended'* sites that had been identified by the MCS based on Seasearch survey data. In this instance visitors were provided with a map, site boundaries, management recommendations, images of the site, recommendation information, current use of the site and environmental benefits of the site. Visitors could choose to vote for or against the nominated site, leave a comment to support their views and complete an optional stakeholder profiling questionnaire providing more detailed information about their use of the area. In total 15,127 votes were cast, 9,300 of which were in favour of particular sites.

based on evidence identified in the review, which is presented in Annex L. The following fundamental assumptions are made in the assessment:

- An ecosystem service benefit is defined (qualitatively) in terms of the economic value derived from the ecosystem service (as shown in the final part of Figure 2)
- If an activity is not permitted within an rMCZ, then it is assumed that no on-site ecosystem service benefits can be realised by participants of that activity.
- In the absence of appropriate evidence on which to base a dynamic baseline assessment, it is assumed that the baseline condition identified will hold constant over the 20 year period of the IA. Therefore, where the condition of rMCZ features are not expected to change as a result of the rMCZ (i.e. a conservation objective of 'maintain in favourable condition') or management of activities is anticipated, no changes to ecological process supported by the feature and thereby ecosystem services is expected i.e. there is no difference between the baseline and the 'with MCZ' situation.
- An increase in visitor numbers to a site equates to an increase in the value of relevant ecosystem services. This can occur even where the rMCZ does not improve the per unit value of the ecosystem services through changes in the underlying ecosystem processes. The increase in value is as a result of an increased number of people benefiting from the ecosystem service. i.e. individuals may visit an area for recreation purposes because of an MCZ designation, regardless of what impact that MCZ is actually having on the environment. However, some rMCZs may also result in increased visitor numbers as a result of improvements in the environment relative to the baseline.
- MCZs may protect features from possible future degradation that could result from currently unknown increases or changes in human activities and pressures. As this potential degradation is not currently anticipated and is therefore not included in the baseline (and may not occur), it is not factored into the assessment of change in economic value. For rMCZs that only have 'maintain' conservation objectives, this safeguarding role is therefore explicitly identified as a benefit in the qualitative description of impacts.
- The assessment is presented as the gross benefit and does not take account of potential costs associated with management of rMCZs. For example, the removal of bottom trawling from an rMCZ may have a beneficial impact on on-site fish populations (through reduced fishing mortality and/or improved habitat condition), which may also result in spill-over effects. On-site benefits through fishing with other gear types, and off-site benefits from spill-over effects may occur. It is therefore concluded that the rMCZ will have a beneficial impact on the ecosystem service category 'fish and shellfish for human consumption'. However, the removal of trawling will also present a cost, as the fish previously caught by bottom trawlers in the rMCZ will no longer be caught (note that the assessment of costs does not account for the effects of displacement). Because the benefits and some of the costs are assessed qualitatively, a net impact is not estimated for the IA. Qualitatively assessed costs and benefits are presented separately within the structure for the IA.

H5.44 The potential change in the value of ecosystem services that is estimated to arise from each rMCZ is summarised using arrows, as set out below. This is presented as the gross benefit and does not take account of potential costs associated with management of rMCZs.

⇧ = Increase in value of ecosystem service

⟺ = No change in value of ecosystem service

H5.45 The level of confidence associated with this assessment is presented alongside the symbol, based on a basic scale of low, moderate or high confidence (as described in Annex H1). A level of confidence is ascribed to each assessment of ecosystem service benefit based on the following rules and assumptions:

- Fish and shellfish for human consumption; Recreation; Regulating services:
  - Low confidence: for any conclusion of an increase in economic value, because of the significant range of influencing factors and uncertainties
  - Moderate confidence: where no change in MCZ feature condition or management is anticipated, no change in economic value is anticipated
- Research:
  - High confidence: where known research activities will take place as part of MCZ ecological baseline and monitoring work
- Education:
  - Low confidence: where the site is not coastal or estuarine
  - Moderate confidence: where the site is coastal or estuarine
- Non-use values:
  - Moderate confidence: as there is good evidence of non-use values, which is not site-specific.

6 Limitations

H5.46 The following limitations apply to the assessment of benefits of rMCZs:

- Valuation of the potential changes in ecosystem service provision was not possible because the necessary information is not available. Consequently, the estimates of the benefits cannot be set directly against the costs that have been estimated in the IA.
- The direction of change in feature condition, as defined by draft conservation objectives, is central to the site-level qualitative assessment. There is significant uncertainty about the accuracy of the draft conservation objectives, given the methodology necessarily employed to derive them. Incorrectly defined draft conservation objectives may result in the anticipated direction of change in ecosystem services being incorrect.

- Evidence of changes in ecosystem services as a result of MPAs (or other relevant regimes) is often disparate and site-specific. The review of available evidence on ecosystem services presented in Annex L may unintentionally exclude some relevant literature. Extrapolation and generalisation of the evidence to the broad range of MCZ locations, conditions and features limits the level of confidence that can be placed on the assessments set out in the Evidence Base, Annex I and Annex L.
- Though it is reasonable to assume that the value of ecosystem services provided by features in favourable condition is likely to be greater than the value of services provided in features that are in unfavourable condition, the assessments are subject to any errors that are made in this assumption.
- The findings of the 'Your Seas Your Voice' campaign are subject to the following limitations:
  - Because the participants in the campaign were self-selecting and not a random sample, the reasons that are presented cannot be assumed to be representative of the UK's population.
  - The findings are subject to bias, arising for example from the influence of the Marine Conservation Society recommended sites and the suggested reasons for wanting an area to be protected that were used in the campaign.

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Appendix 1

Table A1: MCZ IA ecosystem service classification

CORE ECOSYSTEM PROCESSES	BENEFICIAL ECOSYSTEM PROCESSES	BENEFICIAL ECOSYSTEM SERVICES	
Production	Primary production	Fisheries	Food
Decomposition	Secondary production	Other wild harvesting	
Nutrient cycling	Larval/gamete supply	Aquaculture	
Hydrological processes	Biological control	Fertiliser/feed	
Ecological interactions	Food web dynamics	Salt	Raw materials
Evolutionary processes	Species diversification	Ornamental materials (shells)	
Water cycling	Genetic diversification	Biofuels	Energy
	Waste assimilation	Medicines	Physical wellbeing
	Erosion control	Natural hazard protection	
	Formation of species habitat	Environmental resilience	
	Formation of physical barriers	Regulation of pollution	
	Formation of pleasant scenery	Tourism	Psychological/ social wellbeing
	Climate regulation	Recreation/sport	
	Air quality regulation	Spiritual/cultural wellbeing	
	Biogeochemical cycling	Aesthetic benefits	
	Water cycling	Nature watching	

(regulation)	
Water purification (quality)	
Aquaria	
Research and education	Knowledge

Source: Fletcher and others, 2012