Annex I3. Assessment of site-specific impacts arising from rMCZs (over 2013 to 2032)

Irish Sea Conservation Zones rMCZ Project Area

Contents

Recommended Marine Conservation Zone (rMCZ) 1, Mud Hole — Site area (km^2): 72.65

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 1, Mud Hole**

1a. Ecological description

Recommended MCZ 1 consists of an area of deep water mud habitat (depth of 26–38 metres) that is located 21km/10 nautical miles (nm) off the Cumbrian coast in north-west England. This area of subtidal mud contains the following Features of Conservation Importance (FOCI) habitat types: mud in deep water and sea-pens and burrowing animals. These muddy habitats form part of the eastern Irish Sea mud patch, an area that is geographically isolated from the deep water mud habitat in the western Irish Sea (Clements (2010) in ISCZ, 2011). The mud is of high commercial interest as it is the habitat of the Dublin Bay prawn *Nephrops norvegicus*. There are a number of other species which inhabit this sea bed type, including the brittlestar *Amphiura chiajei* and the burrowing sea urchin *Brissopsis lyrifera*. Due to the low light levels, no plants tend to grow at this depth. This means that the marine animals found within the sea bed are a key part of the food chain, linking energy from the plankton to higher trophic levels, such as predatory fish (Bolam and others (2010) in ISCZ, 2011).

Lumb and others (2011, in ISCZ, 2011) mapped the expected distribution of sea-pens and burrowing animals within this part of the Irish Sea. The expected distribution was inferred from survey data and from the presence of the suitable underlying habitat type (Hughes & Atkinson (1997) in ISCZ, 2011). Historically, sea-pens were abundant in this region (Jones and others (1952, cited in Swift, 1993) in ISCZ, 2011), but relatively recent video survey data indicated that they have become rare in this part of the eastern Irish Sea (Hughes & Atkinson (1997) in ISCZ, 2011). Designation of rMCZ 1 may allow for the potential recovery of sea-pens and burrowing animals, a habitat type which is known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	72.65	-	Unfavourable condition	Recover to favourable condition
Species of Conservation Importance				
Seapens and Burrowing Animals	34.77	1	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Mud Habitats in Deep Water	34.77	1	Unfavourable condition	Recover to favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 1, Mud Hole**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Fishers have reported 34 unidentified objects that have caused obstruction to fishing gear in this site which may represent features of archaeological interest (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Commercial fisheries	**rMCZ 1, Mud Hole**
Source of costs of the rMCZ The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling and dredging will be required for certain features protected by this rMCZ. Therefore, two scenarios have been employed in the Impact Assessment (IA) for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range. ***Management scenario 1:*** Entire rMCZ is open to all gear types. ***Management scenario 2:***** Closure of entire rMCZ to bottom trawls and dredges. * This is the same as the management scenario identified by the vulnerability assessment using information collected from stakeholders.	
Summary of all UK commercial fisheries: The rMCZ straddles the 12 nautical mile (nm) limit off the Cumbrian coast. A number of commercial fishing restrictions already exist in the site (listed in Annex E). The rMCZ is located on the edge of one of the two major nephrops fishing grounds in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011a). Of approximately 700 UK vessels that are known to be active in the ISCZ Project Area (MMO, 2011b), at least 30 UK vessels are known to fish in this site (both under and over 15 metre vessels) (ISCZ, 2010). The site is important in terms of value of landings to the Cumbrian and Northern Ireland fishing fleets. Stakeholder meetings have suggested that nearer to 70 vessels fish in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). The 30 vessels	

Table 2b. Commercial fisheries **rMCZ 1, Mud Hole**

(both under and over 15 metre vessels) that are known to fish in the site use primarily bottom trawls to target nephrops in mainly March to October, but they also use dredges to target scallop and mid-water trawls to target herring and prawn. These vessels also land brill, cod, haddock, herring, monkfish, plaice, pollack, rockfish, scallop, shrimp, skate and ray sole, turbot, whitefish and flatfish from this area (ISCZ, 2010).Vessel Monitoring System (VMS) data indicate the use of bottom trawls, dredges and mid-water gear by over 15 metre UK vessels in the area (MMO, 2011a). There is no evidence of the use of hooks and lines, nets, pots and traps in the site. The estimated total value of UK landings from the site is £1.430m/yr (MCZ Fisheries Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries

Bottom trawls: At least 25 UK vessels are known to use bottom trawls in the rMCZ targeting primarily nephrops in March to October (ISCZ, 2010). These vessels are associated with the home ports of Ardglass, Barrow, Fleetwood, Kilkeel, Maryport, Portavogie and Whitehaven (ISCZ, 2010). The site is important in terms of value of landings to the Northern Irish and Cumbrian fishing fleets. Stakeholders have suggested that, in total, nearer to 70 bottom trawlers are active in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). The Cumbrian fleet mostly uses single-rig otter trawls whereas the Northern Irish fleet mostly uses twin-rig and pair otter trawls (ISCZ, 2010). VMS data also provide evidence of bottom trawling by over 15 metre UK vessels in this site (MMO, 2011a).

The estimated value of landings from the site from bottom trawling is £1.076m/yr.

Costs of impact of rMCZ on UK commercial fisheries

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2
Value of landings affected	0.000	1.076

Regarding Scenario 2: Northern Irish fisheries anticipate that closure to bottom trawling in rMCZ 1 will displace their bottom trawlers into fewer and smaller fishing grounds (in between rMCZ 1 and rMCZ 2). They estimate that at least 45 vessels are likely to be affected. These vessels are mostly associated with Kilkeel but also Portavogie. They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation. For most Northern Irish vessels, this may raise questions about the viability of travelling over to the East Irish Sea to fish. Nephrops caught in this site are good quality and are sold 'whole' for a higher price per tonne compared with the nephrop 'tail' market. 'Whole' nephrops obtain a higher price per tonne compared with nephrop 'tails' which are solely for processing into products such as scampi. 'Whole' nephrops are mostly sold abroad as it is popular on the continent to eat them whole. As such, the landings estimate for bottom trawling for this site may not reflect the higher price obtained for whole nephrops compared to tail nephrops. (ANIFPO, 2011; NIFPO, 2011).

Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011).

Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th>rMCZ 1, Mud Hole</th></tr>
<tr><td></td><td colspan="2">manufacturing). (ANIFPO, 2011; NIFPO, 2011).

Regarding Scenario 2: The North Western Inshore Fisheries and Conservation Authority (NWIFCA) and representatives of the Cumbrian fishing fleet report that the closure of bottom trawling in this site is likely to affect around 30 Cumbrian vessels comprising 14 vessels from Whitehaven, 12 vessels from Maryport and fewer than 5 vessels from Barrow and Fleetwood. They feel that, together, closure of bottom trawling in rMCZ 1 and the proposed/operational wind farm developments in the East Irish Sea will 'squeeze' the Cumbrian bottom trawlers into fewer and smaller fishing grounds. Landings to the Cumbrian fleet are anticipated to decrease as a result. Landings from rMCZ 1 contribute to the nephrops market (whole and tail) and there are likely to be knock-on impacts to three fisheries agents as well as to the export market for nephrop products. (Whitehaven fishermen's association & NWIFCA, 2011)

A more detailed description of impacts to the fisheries sector can be found in Annex J and Annex F.</td></tr>
<tr><td>***Dredges:*** Fewer than 5 UK vessels are known to dredge in the site, primarily for scallops in October to April (ISCZ, 2010). These vessels are associated with the home ports of Barrow, Kilkeel and Whitehaven (ISCZ, 2010). Stakeholder meetings have suggested that very few over and under 15 metre UK vessels dredge in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). VMS data also indicates that dredging by over 15 metre UK vessels takes place in the site but that the degree of effort appears to be very low (MMO, 2011a).

The estimated value of landings from the site is £0.015m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:

<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.015</td></tr></table>
Stakeholders have not provided a description of impact for this gear type.</td></tr>
<tr><td colspan="3">**Total direct impact on UK commercial fisheries**</td></tr>
<tr><td></td><td colspan="2">The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:

<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.00</td><td>1.091</td></tr></table></td></tr>
</table>

Table 2b. Commercial fisheries	**rMCZ 1, Mud Hole**

	GVA affected: 0.00 / 0.437 Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in site impacted under each scenario. Scenario 1: 0 Scenario 2: 26 At least 26 UK vessels are likely to be affected (ISCZ, 2010) if Scenario 2 is implemented. Stakeholder meetings have suggested that nearer to 70 vessels may be affected (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011).
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
Part of the rMCZ lies between 6nm and12nm in which the Irish fleet have historic fishing rights to bottom trawl for nephrops. VMS data indicate the use of bottom trawls by over 15 metre Irish vessels in the site (MMO, 2011a). There is no evidence for other non-UK vessel fishing activity in the site.	The Irish fishing fleet has not provided a description of impact. Quantitative estimates are not available.

Table 2c. National defence	**rMCZ 1, Mud Hole**

Source of costs of the rMCZ

Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of most of the site as a firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in the Evidence Base.

Table 2d. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 1, Mud Hole**
Oil and gas related activities (including carbon capture and storage) This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 1, Mud Hole**
Shipping and recreation.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 1, Mud Hole**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use dredges to target scallops and mid-water trawls to target	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawling and dredging. Therefore there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 1, Mud Hole**
herrings and prawns (ISCZ, 2010). See Table 2 for more detail. The benthic (bottom-dwelling) organisms of subtidal mud form an important part of the food chain and transfer organic carbon back into the pelagic (open water) water layers (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom-feeding fish (Hill (2008) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).	the MCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The prohibition of bottom trawling and dredging from the site could potentially open up opportunities for static gear fisheries in the site (see Annex L). There may be benefits for mid-water trawlers which will be allowed to continue fishing in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 1, Mud Hole**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawling and dredging. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)).	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 1, Mud Hole**
sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to their depth and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include sea-pens and burrowing crustaceans, starfish, hermit crabs, harbour crabs, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	Designating the srMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4c. Research and education		**rMCZ 1, Mud Hole**
Baseline	**Beneficial impact**	
The extent of current research activity carried out in the site is unknown. However, Lumb and others (2011, in ISCZ, 2011) and Hughes & Atkinson (1997, in ISCZ, 2011) have studied sea-pens and burrowing animals within this part of the Irish Sea. Clements (2010, in ISCZ, 2011) has studied the deep water mud habitats in and around the site. Finnegan and others ((2009) in Fletcher and others (2012)) have studied subtidal and intertidal sediments in the east Irish Sea.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ 1, Mud Hole**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), one 'nominated site' falls within the boundary of rMCZ 1. The one stakeholder (a recreational fisher) nominated the site because they perceived the area to be under threat. This is an example of the reasons why some people would like areas within this rMCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H5).	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 2, West of Walney — Site area (km^2): 156.37

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 2, West of Walney**

1a. Ecological description

Recommended MCZ 2 is located 8km/4.6 nautical miles (nm) offshore (west) from Walney Island on the Cumbrian coast of north-west England. The depth range of the site is 15–33 metres and the sea bed is composed of two broad-scale habitat types: subtidal mud to the north and subtidal sand to the south. The area of subtidal mud contains the following Features of Conservation Importance (FOCI) habitat types: mud in deep water and sea-pens and burrowing animals. These muddy habitats form part of the eastern Irish Sea mud patch, an area that is geographically isolated from the deep water mud habitat present in the western Irish Sea (Clements (2010) in ISCZ, 2011). The mud is of high commercial interest as it is the habitat of the Dublin Bay prawn *Nephrops norvegicus*. There are, however, a number of other species which inhabit this sea bed type, including the brittlestar *Amphiura chiajei* and the burrowing sea urchin *Brissopsis lyrifera* as well as crabs, shrimps and other species. Due to the low light levels, no plants tend to grow at this depth. This means that the marine animals found within the sea bed are a key part of the food chain, linking energy from the plankton to higher trophic levels, such as predatory fish (Bolam and others (2010) in ISCZ, 2011).

Lumb and others (2011, in ISCZ, 2011) mapped the expected distribution of sea-pens and burrowing animals within this part of the Irish Sea. The expected distribution was inferred from survey data and from the presence of the suitable underlying habitat type (Hughes & Atkinson (1997) in ISCZ, 2011). Historically, sea-pens and burrowing sea urchins *Brissopsis lyrifera* were abundant in this region (Jones and others (1952, cited in Swift, 1993) in ISCZ, 2011), but relatively recent video survey data indicated that they have become rare in this part of the eastern Irish Sea (Hughes & Atkinson (1997) in ISCZ, 2011). Designation of rMCZ 1 may allow for the potential recovery of sea-pens and burrowing animals, a habitat type which is known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	156.37	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Mud Habitats in Deep Water	80.30	1	Unfavourable condition	Recover to favourable condition
Species of Conservation Importance				
Seapens and Burrowing Animals	80.30	1	Unfavourable condition	Recover to favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 2, West of Walney**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Fishers have reported 33 unidentified objects that have caused obstruction to fishing gear in this site. An unidentified aircraft, dated from the mid to late 20th century, is recorded in the site (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Commercial fisheries	**rMCZ 2, West of Walney**
Source of costs of the rMCZ The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling and dredging will be required for certain features protected by this rMCZ. Therefore, two scenarios have been employed in the Impact Assessment (IA) for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range. ***Management scenario 1:*** Entire rMCZ is open to all gear types. ***Management scenario 2:****** Closure of entire rMCZ to bottom trawls (excluding seine nets) and dredges. ***Management scenario 3:*** Closure of entire rMCZ to bottom trawls and dredges. * This is the management scenario identified by the vulnerability assessment using information collected from stakeholders. The regional stakeholder group identified that seine nets do not require additional management in this site.	
Summary of all UK commercial fisheries: The site straddles the 6 nautical mile (nm) and 12nm offshore limits. A number of commercial fishing restrictions already exist in the site (listed in Annex E). The site is important to the Fleetwood, Barrow and Northern Ireland fishing fleets in terms of value of landings, as it is located on the edge of one of the two major nephrops grounds in the Irish Sea (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), at least 31 UK vessels are known to fish in the site (both under and over 15 metre vessels) (ISCZ, 2010). Stakeholder meetings have suggested that nearer to 50 vessels fish in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). The 31 vessels (both under and over 15 metre vessels) that are known to fish in the site, use primarily bottom trawls (in mainly March to October) but they also use dredges, mid-water trawls, pots and traps and nets. They target mainly nephrops but also land a variety of species including bass, crab, lobster, whitefish, cod, plaice, haddock, herring, monkfish, mullet, scallop, shrimp, and skate and ray (ISCZ, 2010). The only known UK seine netters who operate in the ISCZ Project Area (fewer than 5 vessels) have also indicated that they fish in the site targeting plaice, haddock and cod (one of very few seine net fishing grounds) (ISCZ, 2010). Vessel	

Table 2b. Commercial fisheries **rMCZ 2, West of Walney**

Monitoring System (VMS) data indicate the use of bottom trawls by over 15 metre UK vessels in the area (MMO, 2011a). There is no evidence of the use of hooks and lines in the site. The estimated total value of UK landings from the site is £0.730m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries

Bottom trawls: At least 23 UK vessels are known to use bottom trawls in rMCZ 2, targeting primarily nephrops in mainly March to October (ISCZ, 2010). They use single-rig, twin-rig and pair otter trawls. These vessels are associated with the home ports of Ardglass, Barrow, Fleetwood, Kilkeel, Maryport, Portavogie and Whitehaven. Some UK beam trawlers (fewer than five) also visit the site and target mixed whitefish (ISCZ, 2010). Stakeholder meetings suggest that nearer to 50 vessels are active in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). VMS data indicate the use of bottom trawls by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.661m/yr.

The only known UK seine netters who operate in the ISCZ Project Area (fewer than 5 vessels) have also indicated that they fish in the site. This is one of very few seine net fishing grounds in the ISCZ Project Area. (NIFPO, pers. comm., 2011).

Costs of impact of rMCZ on UK commercial fisheries

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2	Scenario 3
Value of landings affected	0.000	0.661	0.661

Note from the author:
Regarding Scenario 2: The Regional Stakeholder Group identified that seine nets do not require additional management in this site. The loss of landings estimate for Scenario 2 is an overestimate as it was not possible to extract the value of landings to the seine netters from the MCZ Fisheries Value Model data.

Comments from representatives of the Northern Ireland fishing fleet:
Regarding Scenarios 2 and 3: Northern Irish fisheries anticipate that closure to bottom trawling in rMCZ 2 will displace their bottom trawlers into fewer and smaller fishing grounds (in between rMCZ 1 and rMCZ 2). They estimate that at least 45 vessels are likely to be affected. These vessels are mostly associated with Kilkeel but also Portavogie. Northern Irish fisheries state that the area is important for night fishing which is complementary to the day fishing areas to the north of rMCZ 2.They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation. For Northern Irish vessels, this may raise questions about the viability of travelling over to the East Irish Sea to fish. Nephrops caught in this site are good quality and are sold 'whole' for a higher price per kilo compared with the nephrop 'tail' market. As such, the landings estimate for bottom trawling for this site may not reflect the higher price obtained for whole nephrops compared to tail nephrops. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011; NIFPO, 2011).

Regarding Scenario 3: Prohibition of seine netting would result in the only known seine netting vessels (who

Table 2b. Commercial fisheries **rMCZ 2, West of Walney**

operate in the ISCZ Project Area) seeking to operate elsewhere. However, with limited fishing grounds it could result in the vessels exiting the industry. (NIFPO, 2011).
Further information on the impacts can be found in Annex J and Annex F.

Dredges: Fewer than 5 UK vessels are known to dredge in the site, targeting primarily scallop all year round (ISCZ, 2010). These vessels are associated with the home ports of Barrow and Kilkeel. Stakeholder meetings have suggested that very few vessels dredge in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). VMS data does not indicate any use of dredges by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £0.029m/yr.

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2	Scenario 3
Value of landings affected	0.000	0.029	0.029

Stakeholders have not provided a description of impact. The evidence of dredging in this site is based largely on FisherMap – where individual fishers have stated that they fish. However, fisheries representatives and NWIFCA do not believe that scallop dredging takes place in this rMCZ. Therefore the cost is likely to be overestimated.

Total direct impact on UK commercial fisheries

At least 24 UK vessels (bottom trawls and dredges) are likely to be affected if Scenarios 2 or 3 are implemented. Stakeholder meetings suggest that nearer to 50 vessels are likely to be affected (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association, 2011).

The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2	Scenario 3
Value of landings affected	0.000	0.690	0.690
GVA affected	0.000	0.278	0.278

Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in site impacted under each scenario.
Scenario 1: 0
Scenario 2: 24
Scenario 3: 25

Baseline description of non-UK fisheries

Irish vessels have historic rights to bottom trawl for nephrops within the portion of the site that lies between 6nm and 12nm offshore. French vessels have historic rights to fish for any species within part of the portion of the site between 6nm and 12nm but are not known to fish the area. VMS data indicates the use of bottom trawls by over 15 metre vessels in the site by Irish vessels (MMO, 2011a). The Belgian fleet has indicated that this site is important to them in terms of value of landings. There are

Costs of impact of rMCZ on non-UK commercial fisheries

Regarding Scenarios 2 and 3: In the view of Belgian fisheries representatives, the proposed restrictions would be a financial 'disaster' for the Belgian fleet and they anticipate that eight Belgian vessels that currently fish in the Irish Sea would be forced to leave the fishing industry. Displacement of effort of Belgian vessels that fish in the site will increase the concentration of vessels into smaller areas, which will increase competition. If fishing grounds are reduced in area, it is anticipated that fishing quota will also be restricted with significant financial repercussions for the Belgian fishing fleet. The Belgian fleet is gradually adopting a new gear type, the Sumwing, which is a lighter gear and impacts the sea bed less. However, if this gear type is prohibited also in the rMCZ, there would be no alternative but for the Belgian vessels to stop fishing in the Irish Sea and potentially stop fishing altogether. It is not feasible for Belgian vessels to adapt to pots and traps to fish in the Irish Sea. (Belgian

Table 2b. Commercial fisheries	**rMCZ 2, West of Walney**
usually no more than three Belgian beam trawlers in the entire Irish Sea at one time but, a total of about eight visit the Irish Sea. The Belgian vessels visit the Irish Sea from October to April (Belgian Fisheries Representative, 2011).	Fisheries Representative, 2011). Quantitative estimates of impact are not available. The Irish fishing fleet has not provided a description of impact. Quantitative estimates are not available.

Table 2c. National defence	**rMCZ 2, West of Walney**
Source of costs of the rMCZ ***Management scenario 1:*** Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of part of the site as a firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. The impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2d. Renewable energy	**rMCZ 2, West of Walney**
Source of costs of the rMCZ ***Management scenario 1:*** Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). ***Management scenario 2:*** Increase in costs of assessing environmental impacts for licence applications and increase in cable protection installation costs for power export cables and inter-array cables (relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Walney Extension wind farm: 10.96km of the proposed and yet to be consented export power cable route for the Walney Extension wind farm passes through the site.	The estimated cost to renewable energy developers operating in this rMCZ is expected to fall within the following range of scenarios: *£m/yr* / Scenario 1 / Scenario 2 Cost to the operator / <0.001 / 0.548 GVA affected / <0.001 / 0.548 ***Scenario 1:*** The licence application for the Walney Extension wind farm cable route will need to consider the potential effects of the development on achieving the conservation objectives of the rMCZ's features. This is expected to result in an additional one-off cost of £0.004m in 2013 (for extra consultant/staff time).

Table 2d. Renewable energy	**rMCZ 2, West of Walney**
	Scenario 2: In addition to the increased costs for assessment set out under Scenario 1, Scenario 2 includes costs of additional mitigation. This additional mitigation entails use of alternative cable protection for export cables and inter-array cables that have not yet been consented. This is expected to result in an additional one-off cost of £10.960m in 2013 (based on estimated additional cost of £1m/km for power export cable only). No inter-array cabling is anticipated to be required in this rMCZ as no existing or planned wind farm developments overlap directly with this rMCZ. These costs are included in Scenario 2 to reflect uncertainty over whether this additional mitigation will be required. However, JNCC and Natural England (pers. comm., 2012) state that the likelihood of this cost occurring is very low. Further details are provided in Annex H14. The impacts assessed in both scenarios are based on JNCC and Natural England's advice on the mitigation that could be required. ***Comments from DONG Energy:*** DONG Energy (the wind farm developer) is concerned that additional costs will be incurred in the Environmental Impact Assessment (EIA) in support of the application for consent for the cable route for the Walney Extension wind farm. It anticipates that these costs will arise from additional surveys and data collection as well as consideration of the impact of the development upon rMCZ features in the site. DONG Energy is also concerned about additional requirements for measures to mitigate the impact of the proposed development upon the rMCZ features, compared with measures that would be undertaken in the absence of the rMCZ as a condition of the marine licence. The developer did not provide an estimate of costs of these anticipated impacts of the rMCZ. (DONG Energy, pers. comm., 2011). ***Comments from Natural England regarding rMCZ 2:*** There is no anticipation that further surveys or monitoring will be required as a result of the MCZ if it is designated. There is no expectation that jack-up vessels would be restricted as a result of the MCZ if it is designated. (Natural England, pers. comm., 2012)

Table 2e. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 2, West of Walney**
Oil and gas related activities (including carbon capture and storage) This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 2, West of Walney**
Existing cables (interconnectors and telecom cables), recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 2, West of Walney**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use dredges, mid-water trawls, nets and pots and traps to target a mix of other species (ISCZ, 2010). See Table 2 for more detail. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into the pelagic (open water) layers (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawling and dredging. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the MCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The prohibition of bottom trawling and dredging from the site could potentially open up opportunities for static gear fisheries in the site (see Annex L). There may be benefits for mid-water trawlers which will be allowed to continue fishing in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration)	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 2, West of Walney**
The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).	identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 2, West of Walney**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawling and dredging. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to their depth and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crab, harbour crab, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**rMCZ 2, West of Walney**
Baseline	**Beneficial impact**	
The extent of current research activity carried out in the site is unknown. However, Lumb and others (2011, in ISCZ, 2011) and Hughes & Atkinson (1997, in ISCZ, 2011) have studied sea-pens and burrowing animals within this part of the Irish Sea. Clements (2010, in ISCZ, 2011) has studied the deep water mud habitats in and around the site..	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ 2, West of Walney**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of 20 members of the public who commented on the potential designation of rMCZ 2, 17 said it was a 'good' or 'very good' idea. Reasons stated included the need to protect marine biodiversity for future generations and to reduce pressure on fish stocks.	Anticipated direction of change: Confidence: Moderate

Proposed Co-location Zone (PCLZ) Site area (km^2): 232.00

The PCLZ is a site identified by the Regional Stakeholder Group to have the potential to become an MCZ. However, it is not currently part of the final suite of recommended rMCZs to the Government. This is because the regional stakeholder group agreed that the decision to recommend the site to the Government would be subject to further discussions between Natural England, the Joint Nature Conservation Committee (JNCC) and the renewable energy developers who have interests in the site. The site is included here as the Regional Stakeholder Group wished to include it in the impact assessment, so that the findings here may inform the ongoing discussions.

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts **PCLZ**

1a. Ecological description

The PCLZ is located 8km/4.6 nautical miles (nm) offshore (west) from Walney Island on the Cumbrian coast of north-west England. The depth range of the site is 15–33 metres and the sea bed is composed of two broad-scale habitat types; subtidal mud to the north and subtidal sand to the south. The area of subtidal mud contains the following Features of Conservation Importance (FOCI) habitat types: mud in deep water and sea-pens and burrowing animals. These muddy habitats form part of the eastern Irish Sea mud patch, an area that is geographically isolated from the deep water mud habitat that is present in the western Irish Sea (Clements (2010) in ISCZ, 2011). The mud is of high commercial interest as it is the habitat of the Dublin Bay prawn *Nephrops norvegicus*. There are, however, a number of other species which inhabit this sea bed type, including the brittlestar *Amphiura chiajei* and the burrowing sea urchin *Brissopsis lyrifera* as well as crabs, shrimps and other species. Due to the low light levels, no plants tend to grow at this depth. This means that the marine animals found within the sea bed are a key part of the food chain, linking energy from the plankton to higher trophic levels, such as predatory fish (Bolam and others (2010) in ISCZ, 2011).

Lumb and others (2011, in ISCZ, 2011) mapped the expected distribution of sea-pens and burrowing animals within this part of the Irish Sea. The expected distribution was inferred from survey data and from the presence of the suitable underlying habitat type (Hughes & Atkinson (1997) in ISCZ, 2011). Historically, sea-pens and burrowing sea urchins *Brissopsis lyrifera* were abundant in this region (Jones and others (1952, cited in Swift, 1993) in ISCZ, 2011), but relatively recent video survey data indicated that they have become rare in this part of the eastern Irish Sea (Hughes & Atkinson (1997) in ISCZ, 2011). Designation of PCLZ as an rMCZ may allow for the potential recovery of sea-pens and burrowing animals, a habitat type which is known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).

The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones and others, 2000). Source: ISCZ (2011)

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	159.91	-	Unfavourable condition	Recover to favourable condition
Subtidal Sand	71.98	-	Unfavourable condition	Recover to favourable condition

Habitats of Conservation Importance				
Mud Habitats in Deep Water	54.98	1	Unfavourable condition	Recover to favourable condition
Species of Conservation Importance				
Seapens and Burrowing Animals	54.98	1	Unfavourable condition	Recover to favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the PCLZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**Proposed Co-location Zone**
Source of costs of the PCLZ	
Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the PCLZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of PCLZ on the sector**
Fishers have reported 51 unidentified objects that have caused obstruction to fishing gear in this site. One named and dated wreck has been identified and recorded in the site – that of a British merchant steamer (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this PCLZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the PCLZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Commercial fisheries	**Proposed Co-location Zone**
Source of costs of the PCLZ	
JNCC and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling and dredging will be required for certain features potentially protected by the PCLZ. Therefore, two scenarios have been employed in the IA for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range. ***Management scenario 1:*** Entire PCLZ is open to all gear types. ***Management scenario 2:***** Closure of entire PCLZ to bottom trawls (excluding seine nets) and dredges. ***Management scenario 3:*** Closure of entire PCLZ to bottom trawls and dredges. * This is the management scenario identified by the vulnerability assessment using information collected from stakeholders. The regional stakeholder group identified that seine nets do not require additional management in this site. The loss of landings estimate for Scenario 2 will be an overestimate as it was not possible to extract the value of landings to the seine netters from the MCZ Fisheries Value Model.	

Table 2b. Commercial fisheries **Proposed Co-location Zone**

Summary of all UK commercial fisheries: The site straddles the 6 nautical mile (nm) and 12nm lines offshore. A number of commercial fishing restrictions already exist in the site (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), at least 25 UK vessels are known to fish in the site (both under and over 15 metre vessels) (ISCZ, 2010). Stakeholder meetings have suggested that nearer to 50 UK vessels fish in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). The 25 UK vessels (both under and over 15 metre vessels) that are known to fish in the site, use primarily bottom trawls to target nephrops in the site (March to September) but they also use beam trawls, mid-water trawls, drift nets, dredges, pots and traps (ISCZ, 2010). The only known UK seine netters who operate in the ISCZ Project Area (fewer than 5 vessels) have also indicated that they fish in the site targeting plaice, haddock and cod (ISCZ, 2010). Vessel Monitoring System (VMS) data indicate the use of bottom trawls by over 15 metre UK vessels in the area (MMO, 2011a). There is no evidence of the use of hooks and lines in the site. The estimated total value of UK landings from the site is £0.414m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

There are currently no fishing exclusion zones in place around the wind farms in the PCLZ. However, during the construction of Walney (phases 1 and 2) wind farm, a 500 metre radius safety zone was enforced around the construction vessels and a 50 metre radius safety zone advised to fishers around the turbines. Exclusions do not apply during operation of the wind farm unless maintenance activities require a 500 metre radius safety zone around the construction vessels. Vessels are recommended to stay 10 metres away from each individual turbine and to not anchor within the immediate vicinity of the turbines (and the substation), but this is not enforced. It is anticipated that the same fishing exclusions will be applied if and when the West of Duddon Sands and Walney Extension wind farms are constructed.

During construction of the Ormonde wind farm (1 May 2010 to 30 November 2010; 1 April 2011 to 31 September 2011), a 500 metre radius advisory safety zone was requested (but not enforced) round all construction vessels while in the wind farm construction area. A 50 metre advisory safety zone was requested (but not enforced) around each turbine and sub-station structure after installation. Following installation of the export cable (since 30 November 2010), a 250 metre anchor exclusion zone is requested (but not enforced) along the export cable route.

Baseline description of UK commercial fisheries

***Bottom trawls*:** At least 20 vessels are known to use bottom trawls in the site, targeting primarily nephrops in mainly March to September (ISCZ, 2010). They comprise single-rig, twin-rig and pair otter trawlers. These vessels are associated with the home ports of Ardglass, Barrow, Fleetwood, Kilkeel, Maryport, Portavogie and Whitehaven (ISCZ, 2010). There are also fewer than 5 UK beam trawlers working the site for mixed whitefish from September to May. Stakeholder meetings suggest that nearer to 50 vessels use bottom trawls in the site (ANIFPO, 2011; NIFPO, 2011 Whitehaven Fishermen's Association & NWIFCA, 2011). VMS data indicate the use of bottom trawls by over 15 metre UK vessels in the site (MMO, 2011a).

The estimated value of landings from the site is £0.347m/yr.

The value of landings for this site is likely to be an

Costs of impact of PCLZ on UK commercial fisheries

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2	Scenario 3
Value of landings affected	0.000	0.347	0.347

These values are likely to be over-estimates for the reasons given in the baseline.

Note from the author: *Regarding Scenarios 2 and 3:* The regional stakeholder group identified that seine nets do not require additional management in this site. The loss of landings estimate for Scenario 2 will be an overestimate as it was not possible to extract the value of landings to the seine netters from the MCZ Fisheries Value Model.

Comments from representatives of the Northern Ireland fishing fleet: *Regarding Scenarios 2 and 3:* Northern Irish fisheries anticipate that in response to closure of the PCLZ to bottom trawls, the fishing effort of their bottom trawlers will be displaced into fewer and smaller fishing grounds (to the north of PCLZ and rMCZ 2). They estimate that at least 45 vessels are likely to be affected. These vessels are mostly associated with Kilkeel but also Portavogie. Northern Irish fisheries state that the area is important for night fishing which is complementary to the day fishing areas to the north of PCLZ and rMCZ 2. The loss of these nephrops grounds may raise questions about the viability for most Northern Irish vessels to continue to travel to the East Irish Sea to fish. This site is

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries Proposed Co-location Zone</th></tr>
<tr><td>overestimate. This is because planned and operational wind farms in the PCLZ restrict fishing activity during construction and maintenance activities. In reality, the presence of turbines and cabling in the PCLZ also deters fishing activity and will increase in the future as more planned wind farms in the site become operational.</td><td>important as good quality nephrops for the 'whole' market are fished from the site. 'Whole' nephrops obtain a higher price per tonne compared with nephrop 'tails' which are solely for processing into products such as scampi. 'Whole' nephrops are mostly sold abroad as it is popular on the continent to eat them whole. As such, the landings estimate for bottom trawling for this site may not reflect the higher price obtained for whole nephrops compared to tail nephrops. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011; NIFPO, 2011).

Regarding Scenario 3: The only known UK seine netters who operate in the ISCZ Project Area (fewer than 5 vessels) have indicated that they fish in the site. The fishing grounds here are one of only a few seine net fishing grounds in the ISCZ Project Area. Prohibition of seine netting would result in the only known seine netting vessels (who operate in the ISCZ Project Area) seeking to operate elsewhere. However, with limited fishing grounds it could result in the vessels exiting the industry. (NIFPO, 2011). Further detail on impacts to the fisheries sector can be found in Annex J and Annex F.</td></tr>
<tr><td>Dredges: At least 5 UK vessels are known to dredge in the site, targeting primarily scallop from October to March (ISCZ, 2010). They are Northern Irish vessels. Stakeholder meetings have suggested that very few vessels dredge in the site (ANIFPO, 2011; NIFPO, 2011). There are no VMS data (for over 15 metre vessels) for this activity in the site (MMO, 2011a).
The estimated value of landings from the site is £0.042m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table>
<tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr>
<tr><td>Value of landings affected</td><td>0.000</td><td>0.042</td><td>0.042</td></tr>
</table>
Stakeholders have not provided a description of impact. The evidence of dredging in this site is based largely on FisherMap – where individual fishers have stated that they fish. However, fisheries representatives and NWIFCA do not believe that scallop dredging takes place in this PCLZ. Therefore the cost is likely to be overestimated.</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td>The value of landings affected by this site is likely to be an overestimate. This is because planned and operational wind farms in the PCLZ restrict fishing activity during construction and maintenance activities.</td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table>
<tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr>
</table></td></tr>
</table>

Table 2b. Commercial fisheries	**Proposed Co-location Zone**
In reality, the presence of turbines and cabling in the PCLZ also deters fishing activity and will increase in the future as more planned wind farms in the site become operational.	<table><tr><td>Value of landings affected</td><td>0.000</td><td>0.388</td><td>0.388</td></tr><tr><td>GVA affected</td><td>0.000</td><td>0.158</td><td>0.158</td></tr></table> These values are likely to be over-estimates for the reasons given in the baseline. At least 21 UK vessels (mostly bottom trawlers, seine netters and dredgers) are likely to be affected if Scenarios 1 or 2 are implemented (ISCZ, 2010). Stakeholder meetings suggest that nearer to 50 vessels would be affected (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in site impacted under each scenario. Scenario 1: 0 Scenario 2: 21 Scenario 3: 22
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
Irish vessels have historic rights to bottom trawl for nephrops within the portion of the site that lies between 6nm and 12nm offshore. French vessels have historic rights to fish for any species within a part of the 6nm to 12nm area but are not known to fish there. Irish vessels (bottom trawlers) are known to fish in the site (MMO, 2011a).	The Irish fishing fleet has not provided a description of impact. Quantitative estimates are not available.

Table 2c. Renewable Energy	**Proposed Co-location Zone**
Source of costs for the PCLZ Scenario 1: Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Scenario 2: Increase in costs of assessing environmental impacts for licence applications and increase in cable protection installation costs for power export cables and inter-array cables (relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of PCLZ on the sector**
The potential co-location zone overlaps with 60km^2 of the proposed Walney Extension wind farm (which is in the pre-planning stage and not yet consented); 59km^2 of the West of Duddon Sands wind farm (consented and under construction); 30km^2 of the Walney wind farm phase 1 (now operational); 43km^2 of Walney wind farm	The estimated cost to renewable energy developers operating in this rMCZ is expected to fall within the following range of scenarios: <table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td><0.001</td><td>0.624</td></tr><tr><td>GVA affected</td><td><0.001</td><td>0.624</td></tr></table>

Table 2c. Renewable Energy	**Proposed Co-location Zone**
phase 2 (now operational); and 9km^2 of the Ormonde wind farm (now operational). This includes the turbines and array cables associated with these wind farms. The following wind farm power export cable routes fall within the potential co-location zone (no detail is available for existing or proposed array cables): 0.87km of the Walney (phase 1) wind farm export cable route; 14km of the proposed Walney (phase 2) wind farm export cable route; 12.48km of the proposed export cable routes for the Walney Extension wind farm; and 0.54km of the export cable route for the Ormonde wind farm.	***Scenario 1:*** The licence application for the Walney Extension wind farm and export cable route will need to consider the potential effects of the development on achieving the conservation objectives of the rMCZ's features. This is expected to result in an additional one-off cost of £0.004m in 2013 (for extra consultant/staff time). ***Scenario 2:*** In addition to the increased costs for assessment set out under Scenario 1, Scenario 2 includes costs of additional mitigation. This additional mitigation entails use of alternative cable protection for export cables and inter-array cables that have not yet been consented. This is expected to result in an additional one-off cost of £12.480m in 2013 (based on estimated additional cost of £1m/km for yet-to-be-consented power export cable route only). These costs are included in Scenario 2 to reflect uncertainty over whether this additional mitigation will be required. The additional cost to install alternative cable protection for inter-array cables is not quantified. This could be a significant unknown cost. However, JNCC and Natural England (pers. comm., 2012) state that the likelihood of this cost occurring is very low. Further details are provided in Annex H14. The impacts that are assessed in both scenarios are based on JNCC and Natural England's advice on the mitigation that could be required. An alternative assessment of the mitigation of impacts that may be needed has been provided by DONG Energy (the wind farm developer in the site) which results in a different estimate of the costs. DONG Energy's assumptions about the additional mitigation that could be required are different from the advice provided by JNCC and Natural England (see Annex H14). ***Comments from DONG Energy:*** DONG Energy is concerned that the designation of the PLCZ as an MCZ could cost it in the region of £79m to £169m (present value) over the 20-year period of the IA analysis. This is based on a concern that additional costs could be incurred as a condition of the marine licence. These additional costs could comprise additional data collection, impact analysis and modelling in the Walney Extension Environmental Impact Assessment (EIA), additional data collection and impact monitoring post consent for the Walney Extension and West of Duddon Sands wind farms, and additional data collection and impact monitoring for all of the wind farms in the PCLZ after construction and during operation and maintenance. The cost also includes additional costs if jack-up vessels are no longer permitted in the operation and maintenance of the wind farms over the 20-year period of the IA, and a floating crane needs to be used instead. Other costs not quantified but of concern to DONG Energy if this site were to be designated as an MCZ are the potential additional costs to design and construct alternative foundations and scour protection measures, to commission an alternative to jack-up vessels in the site (if available) and to design and use alternative cable-laying techniques. This mitigation is additional to the mitigation that it is anticipated would be provided in the baseline.

Table 2c. Renewable Energy	Proposed Co-location Zone
	DONG Energy is also concerned that such additional costs and delays could undermine the commercial viability of the operational and yet-to-be-completed wind farms. It is concerned that resultant losses in capital investments (sunk up until the point of MCZ designation) and anticipated forward revenue streams could amount to billions of pounds. (DONG Energy, pers. comm., 2011) ***Comments from Natural England regarding PCLZ:*** It is not anticipated that further surveys or monitoring will be required as a result of this MCZ if it is designated. There is no expectation that jack-up vessels would be restricted as a result of the MCZ if it is designated. (Natural England, pers. comm., 2012)

Table 2d. Other impacts that are assessed for the suite of MCZs and not for this site alone	Proposed Co-location Zone
Oil and gas related activities (including carbon capture and storage) PCLZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the PCLZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the PCLZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	Proposed Co-location Zone
Cables (existing interconnectors and telecom cables), recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the PCLZ contribute to the delivery of a range of ecosystem services. Designation of the PCLZ as an rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		PCLZ
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are	Anticipated direction of change:

Table 4a. Fish and shellfish for human consumption		**PCLZ**
Nephrops fishing grounds in the Irish Sea project area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use beam trawls, mid-water trawls, drift nets, dredges, pots and traps to target a range of other species (ISCZ, 2010). See Table 2 for more detail. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into the pelagic (open water) layers (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)). Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011). The PCLZ has strong stakeholder support from the Irish Sea *Nephrops* trawling sector. Although the zone supports *Nephrops*, the *Nephrops* trawling sector consider themselves effectively excluded from the area, now or in future, by offshore wind farm developments.	expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawling and dredging. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the MCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The prohibition of bottom trawling and dredging from the site could potentially open up opportunities for static gear fisheries in the site (see Annex L). There may be benefits for mid-water trawlers which will be allowed to continue fishing in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. Designation of the PCLZ would contribute to meeting the Ecological Network Guidance (ENG) targets for subtidal mud broad-scale habitats and FOCI without adding to displacement pressures on the fishing industry (ISCZ, 2011). This is because fishing activity will effectively be excluded from the site due to existing and planned wind farm developments in the site. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the PCLZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	⇧ Confidence: Moderate

Table 4b. Regulating services		**PCLZ**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:***	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawling and dredging. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the PCLZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to their depth and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crab, harbour crab, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**PCLZ**
Baseline	**Beneficial impact**	
The extent of current research activity carried out in the site is unknown. However, Lumb and others (2011, in ISCZ, 2011) and Hughes & Atkinson (1997, in ISCZ, 2011) have studied sea-pens and burrowing animals within this part of the Irish Sea. Clements (2010, in ISCZ, 2011) has studied the deep water mud habitats in and around the site. Numerous surveys have been undertaken in the site associated with the wind farm developments. This comprises benthic surveys, fisheries surveys, acoustic surveys etc.	Monitoring the PCLZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. However, as a lot of research is already being conducted in the site on the impact of wind farms on the benthic flora and fauna, designation of the site as an MCZ is unlikely to change this considerably. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ	Anticipated direction of change: ⇔ Confidence: High

Table 4d. Non-use and option values		**PCLZ**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of 20 members of the public who commented on the potential designation of PCLZ, 17 said it was a 'good' or 'very good' idea. Reasons stated included the need to protect marine biodiversity for future generations and to reduce pressure on fish stocks.	Anticipated direction of change: Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 3, North St George's Channel — Site area (km^2): 1388.03

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts	**rMCZ 3, North St George's Channel**

1a. Ecological description

Recommended MCZ 3 is a large zone in the mid-Irish Sea with biological, geological and geomorphological features of interest. The depth of the area ranges from 40 metres to170 metres and it is located approximately 23km/12 nautical miles (nm) north-west from the coast of Anglesey in north Wales. The horse mussel *Modiolus modiolus* beds in this area support a range of filter-feeding animals, for example acorn barnacles *Balanus balanus*, hydroids and soft corals (Rees (2005) in ISCZ, 2011). Horse mussel beds support a range of other suspension feeders, providing a link in the food chain by connecting primary production in the plankton to the sea bed organisms (Tyler-Walts (2007) in ISCZ, 2011). Bivalves also play a key role in unlocking the energy of primary producers, which in the sea are the phytoplankton (microscopic algae), making it available to be used as food by other creatures. As such, primary producers are the very basis of the food chain that provides the fish consumed by humans.

Tube-dwelling Ross worms *Sabellaria spinulosa* have also been recorded in two surveyed areas; one over the horse mussel beds (Rees (2005) in ISCZ, 2011) and the other over the Croker Carbonate Slabs (JNCC (2011) in ISCZ, 2011). *Sabellaria spinulosa* is a tube worm which ingests particles from the surrounding water and excretes a cement-like substance to form the tube in which it lives. Collectively, these worms can form dense aggregations, or reefs, which stabilise the substrate and provide an important habitat for a host of other species (Maddock (2010) in ISCZ, 2011). However, it is not confirmed whether these localised occurrences of *Sabellaria spinulosa* currently constitute a biogenic reef. Therefore, the species has been noted as present but not designated as a reef. The Croker Carbonate Slabs is an area within rMCZ 3 that has been recommended to the Department for Environment, Food and Rural Affairs (Defra) as a Special Area of Conservation (SAC). It has a high abundance of Ross worm *Sabellaria spinulosa* and submarine structures made by leaking gases. These methane-derived carbonate structures provide a unique sea bed habitat for a range of soft corals, filter feeders, sponges, tube worms and anemones (Whomersley and others, 2010; JNCC (2011) in ISCZ, 2011).

The majority of the sea bed in this area is composed of subtidal sands and gravels. This is a very common substrate type throughout UK waters. In this region, sands and gravels tend to support an abundance of bivalves and polychaete worms. Bolam and others (2010, in ISCZ, 2011) identified molluscs and annelid worms which live within the sediment as the main secondary producers in this part of the Irish Sea. These animals are a key part of the food chain; they recycle organic matter from within the sediment, linking primary production from the plankton to predatory fish (Bolam and others (2010) in ISCZ, 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).

There are two additional broad-scale habitat types present in rMCZ 3: high and moderate energy circalittoral rock, or bedrock on the sea floor which is subject to a high to moderate level of wave and tidal energy. The majority of these broad-scale habitat types have been captured within rMCZ Reference Area B, which is situated in the central north-eastern part of rMCZ 3. Boulders and cobbles present in rMCZ 3 (specifically the north-west corner) are home to animal species such as the tube worm *Pomatoceros triquete* and the soft coral, dead man's fingers *Alcyonium digitatum* along with hydroids, such as *Abietinaria abietin* (Blyth-Skyrme and others, (2008) in ISCZ, 2011).

Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. St George's Channel is a key part of their migratory route utilising the nutrient-rich waters formed by tidal mixing currents (Stephan and others (2011) in ISCZ, 2011). Recommended MCZ 3 is an important area for foraging sea birds that breed in Welsh (often Special Protection Area (SPA)) colonies. Gannets, Manx shearwaters, fulmars, guillemots and puffins are sea bird species that are highly likely to forage at this location. The northern section of the site contains an important pelagic front, which is heavily used by a number of

species. Locally, guillemots *Uria aalge* feed on sand eels, herrings and sprats; puffins *Fratercula arctica* feed on sand eels and capelins; gannets *Morus bassanus* feed on mackerel, herrings and sand eels; Manx shearwaters *Puffinus puffinus* feed on herrings, sprats, whitebait and pilchards (RSPB, pers comm., 2011).

Recommended MCZ 3 includes part of an extensive and regionally important drumlin field. These palaeo-ice flow parallel bedforms are, on average, 100–400 metres long and 1–20 metres high. The drumlins on the sea floor between Anglesey and the Isle of Man are a small subset of these subglacial landforms associated with the last Irish Sea Ice Stream (ISIS). The ISIS advanced out of source areas in Scotland and other mountain regions more than 34,000 years ago, reaching maximum extent at the Scillies c.24,000 years and declined to evacuate the northern Irish Sea basin around 19,000 years, with a re-advance in the northern sector around 17,000 years ago. Blyth-Skyrme and others (2008) found patches of boulder reef that were associated with the drumlin landforms. These areas complied with the definition of reef according to the EC Habitats Directive (CEC, 2007) in that they were comprised of cobbles and boulders, were topographically distinct from the surrounding area, and supported a typical reef fauna, comprised of hydroids, soft corals and bryozoans. Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	**Area of feature (km^2)**	**No. of point records**	**Baseline**	**Impact of MCZ**
Broad-scale Habitats				
High Energy Circalittoral Rock	9.48	-	Favourable condition	Maintain at favourable condition
Moderate Energy Circalittoral Rock	40.07	-	Favourable condition	Maintain at favourable condition
Subtidal Biogenic Reefs	20.07	-	Unfavourable condition	Recover to favourable condition
Subtidal Coarse Sediment	901.06	-	Favourable condition	Maintain at favourable condition
Subtidal Mixed Sediment	30.90	-	Favourable condition	Maintain at favourable condition
Subtidal Sands	336.16	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Horse Mussel Beds	20.01	3	Unfavourable condition	Recover to favourable condition
Subtidal Sands and Gravels	1222.02	5	Unfavourable condition	Recover to favourable condition
Additional Features of Ecological/Geological Importance				
Croker Carbonate Slabs and Drumlins				

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries **rMCZ 3, North St George's Channel**

Source of costs of the rMCZ

The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, dredging, hooks and lines, and nets, and pots and traps will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the Impact Assessment (IA) for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be

Table 2a. Commercial fisheries **rMCZ 3, North St George's Channel**

designated, the management required will fall somewhere within this range.
There are no fisheries restrictions in the extension to the rMCZ made by the regional stakeholder group to provide protection for Drumlins (features of geological importance). This boundary change was made by the regional stakeholder group on condition that no fisheries restrictions would be put in place in the area that is the extension.
Management scenario 1: Entire rMCZ is open to all gear types.
Management scenario 2:*** Closure of entire rMCZ to bottom trawls (excluding seine nets) and dredges, and closure of areas of Sub-tidal Biogenic Reefs and Horse Mussel Beds in the rMCZ to pots and traps.
Management scenario 3: Closure of entire rMCZ to bottom trawls and dredges and closure of areas of Horse Mussel Beds to hooks and lines, nets, pots and traps only.
* This is the management scenario identified by the vulnerability assessment using information collected from stakeholders.

Summary of all UK commercial fisheries: The site lies completely outside the 12 nautical miles (nm) limit. A number of commercial fishing restrictions already exist in the site (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), at least 29 UK vessels are known to fish in this site (both under and over 15 metre vessels) (ISCZ, 2010). These vessels use bottom trawls, dredges, pots and traps, seine nets, mid-water trawls, long lines and gill nets. They target primarily nephrops but also scallop, whelk, shrimp, whitefish, herring, haddock, plaice, brill, lobster, skate and ray, turbot, monkfish, spurdog and dogfish. The fishing grounds in this rMCZ are important to the few remaining seine netters who work in the Irish Sea as it is one of their few remaining fishing grounds (NIFPO, pers. comm., 2011). Vessel Monitoring System (VMS) data for over 15 metre vessels indicate the use of bottom trawls, mid-water trawls, seine nets, pots and traps, and hooks and lines in the site (MMO, 2011a). The estimated total value of UK landings from the site is £0.363m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: At least 16 UK vessels are known to use bottom trawls in the site targeting primarily nephrops throughout the year (ISCZ, 2010). They comprise single-rig, twin-rig and pair trawlers. These vessels are associated with the home ports of Ardglass, Kilkeel and Portavogie (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data indicate the use of bottom trawls by over 15 metre UK vessels in the site (MMO, 2011a). Northern Irish fisheries state that their vessels fish in the top left corner of rMCZ 3 (NIFPO, 2011).Fishing grounds in this part of the rMCZ are very important to the few remaining seine netters in the Irish Sea as it is one of their few remaining fishing grounds. (NIFPO, 2011). The estimated value of landings from the site is £0.312m/yr.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.312 | 0.312 ***Comments from representatives of the Northern Ireland fishing fleet:*** *Regarding Scenarios 2 and 3:* Northern Irish fisheries anticipate that rMCZ 3 will displace their bottom trawlers into fewer and smaller fishing grounds. They suggest that their vessels are unlikely to target different species or change gear type as there are few other viable stocks in the Irish Sea to target. Northern Irish fisheries estimate that up to 10 Northern Ireland vessels may switch to dredging for queenies in response to closure of the site but any more than this number would reduce the quota share per vessel, which is likely to make fishing unviable. They feel that there may be fishing opportunities in the herring fishery if the fishery could obtain MSC accreditation but this requires investment that the industry does not have. Plus, only vessels with available capital to invest would be able to change. Overall, designation of this rMCZ will result in a reduction of landings for those vessels affected. (ANIFPO, 2011; NIFPO, 2011) Prohibition of seine netting would result in the only known seine netting vessels (who operate in the ISCZ Project Area) seeking to operate elsewhere. However, with limited fishing grounds it could result in the vessels exiting the industry. (NIFPO, 2011). Further information on the impacts can be found in Annex J and Annex F.
Pots and traps: Fewer than 5 UK vessels are known to	The annual value of UK landings affected is estimated to fall within the following range:

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ 3, North St George's Channel</th></tr>
<tr><td>use pots and traps in the site throughout the year, targeting primarily whelks (ISCZ, 2010). They are associated with the home port of Holyhead (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number is low (Stakeholder Focus Meeting, 2011). VMS data indicate the use of pots and traps by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.009m/yr.</td><td><table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td>0.000</td></tr></table>Stakeholders have not provided a description of impact. There is no evidence of pots and traps being used in the area of Sub-tidal Biogenic Reefs or Blue Mussel Beds.</td></tr>
<tr><td>Dredges: Fewer than 5 UK vessels are known to dredge in the site (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number is low (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is £0.020m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.020</td><td>0.020</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Hooks and lines: Fewer than 5 UK vessels are known to use hooks and lines in the site targeting spurdog, thornback rays and dogfishes (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number is low (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Nets: Fewer than 5 UK vessels are known to use nets in the site targeting brill, lobster, thornback ray, turbot and monkfish (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number is low (Stakeholder Focus Meeting, 2011). The estimated value of landings from the site is <£0.001m /yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Total direct impact on UK commercial fisheries</td></tr>
<tr><td></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th>rMCZ 3, North St George's Channel</th></tr>
<tr><td colspan="2"></td><td>
<table>
<tr><th>£m/yr</th><th>Scenario 1</th><th>Scenario 2</th><th>Scenario 3</th></tr>
<tr><td>Value of landings affected</td><td>0.000</td><td>0.332</td><td>0.332</td></tr>
<tr><td>GVA affected</td><td>0.000</td><td>0.134</td><td>0.134</td></tr>
</table>
At least 20 UK vessels could be affected if Scenarios 2 or 3 are implemented. They use bottom trawls, dredges, nets, hooks and lines, and pots and traps (ISCZ, 2010). Stakeholder meetings suggested that the total number of vessels fishing in the site is low (Stakeholder Focus Meeting, 2011).
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in site impacted under each scenario.
Scenario 1: 0
Scenario 2: 20
Scenario 3: 22</td></tr>
<tr><th colspan="2">Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td colspan="2">VMS data indicates the use of beam and bottom trawls by Irish and Belgian over 15 metre vessels in the site. There is no evidence of other non-UK vessels fishing in the area (MMO, 2011a). There are usually no more than three Belgian beam trawlers in the entire Irish Sea at one time but, a total of about eight visit the Irish Sea. (Belgian Fisheries Representative, 2011). The Belgian vessels visit the Irish Sea from October to April.
There is no VMS data evidence that the French fleet is active in the site. However, data provided by Direction des Pêches Maritimes et de l' Aquaculture (2011) indicates that there is a low value of landings from French vessels from the site for mobile gear (<£0.001m/yr) .</td><td>Comments from representatives of Belgian fisheries: Regarding Scenarios 2 and 3: In the view of Belgian fisheries representatives, the proposed restrictions would be a financial 'disaster' for the Belgian fleet and they anticipate that eight Belgian vessels that currently fish in the Irish Sea would be forced to leave the fishing industry. Displacement of effort of Belgian vessels that fish in the site will increase the concentration of vessels into smaller areas, which will increase competition. If fishing grounds are reduced in area, it is anticipated that fishing quota will also be restricted with significant financial repercussions for the Belgian fishing fleet. The Belgian fleet is gradually adopting a new gear type, the Sumwing, which is a lighter gear and impacts the sea bed less. However, if this gear type is prohibited also in the rMCZ, there would be no alternative but for the Belgian vessels to stop fishing in the Irish Sea and potentially stop fishing altogether. It is not feasible for Belgian vessels to adapt to pots and traps to fish in the Irish Sea. (Belgian Fisheries Representative, 2011). Quantitative estimates of impact are not available.
The Irish and French fleets have not provided a description of impact. Quantitative estimates of impact are not available for the Irish or Belgian fleets. The impact on the French fleet is estimated to be a loss of <£0.001m/yr for mobile gear (Direction des Pêches Maritimes et de l' Aquaculture, 2011). However, no breakdown of this estimate is available by gear and so it may include the value of landings from mobile gear other than bottom trawling which would not be affected.</td></tr>
</table>

Table 2b. National defence **rMCZ 3, North St George's Channel**

Source of costs of the rMCZ

Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.

Baseline description of activity	Costs of impact of rMCZ on the sector
The Ministry of Defence is known to make use of part of the site as a firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2c. Renewable energy **rMCZ 3, North St George's Channel**

Source of costs of the rMCZ

Management scenario 1: Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline).

Management scenario 2: Increase in costs of assessing environmental impacts for licence applications and increase in cable protection installation costs for power export cables and inter-array cables (relative to the mitigation provided in the baseline).

Baseline description of activity	Costs of impact of rMCZ on the sector
The site overlaps 24km^2 of Centrica's Round 3 (Zone 9) Irish Sea area of search. The Round 3 (Zone 9) area of search covers an area of 2200km^2. Centrica is currently in the process of identifying which parts of the Round 3 (Zone 9) area are suitable wind farm sites. Not all of the area will be suitable. The first potential wind farm sites, and therefore any that may be located in the rMCZ, will be identified in 2013. Centrica has indicated that the area of Round 3 (Zone 9) within this rMCZ is likely to be unsuitable for wind farm development (Centrica website, pers. comm., 2011). The National Grid 2011 Offshore Development Information Statement indicates that an offshore DC cable will be required in the vicinity of this site within the 20-year period of the IA analysis in order to connect the offshore wind farms to the National Electricity Transmission System. No further information is	The estimated cost to renewable energy developers operating in this rMCZ is expected to fall within the following range of scenarios: *£m/yr* | Scenario 1 | Scenario 2 Cost to the operator | Confidential | 2.025 GVA affected | | 2.025 ***Scenario 1:*** The licence applications for wind farms proposed in the Round 3 Irish Sea area of search will need to consider the potential effects of the developments on achieving the conservation objectives of the rMCZ's features. This is expected to result in an additional one-off cost (for extra consultant/staff time). Centrica has requested that the cost estimates it has provided for this are not provided here due to commercial sensitivity. Consequently, an average of estimates provided by Centrica and the other seven developers is used for this rMCZ (in both scenarios). Annex N13 and Annex H14 provide more detail. ***Scenario 2:*** In addition to the increased costs for assessment set out under Scenario 1, Scenario 2 includes costs of additional mitigation. This additional mitigation entails use of alternative cable protection for export cables and inter-array cables that have not yet been consented. This is expected to result in an additional one-off cost of

Table 2c. Renewable energy	**rMCZ 3, North St George's Channel**
available.	£40.400m in 2022 (based on estimated additional cost of £1m/km of power export cable only; year not known so mid-point year of IA period used). No inter-array cabling is anticipated to be required in this rMCZ. These costs are included in Scenario 2 to reflect uncertainty over whether this additional mitigation will be required. However, JNCC and Natural England (pers. comm., 2012) state that the likelihood of this cost occurring is very low. Further details are provided in Annex H14. The impacts that are assessed in both scenarios are based on JNCC and Natural England's advice on the mitigation that could be required. An alternative assessment of cost has been provided by Centrica. The assumptions made in this about the mitigation that may be required are provided by Centrica and differ from the advice provided by JNCC and Natural England. ***Comments from Centrica:*** Centrica is concerned that the designation of rMCZ 3 could incur significant additional costs for its future developments. It is concerned that additional surveys, impact analysis and data monitoring could be required for the Environmental Impact Assessment (EIA). It is also concerned that the additional data and analysis would incur additional time to the Marine Management Organisation, the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the Infrastructure Planning Commission to consider the licence applications and that these additional costs could be invoiced to Centrica, in particular if there was a need to commission expert advice. In terms of additional mitigation costs, Centrica anticipates that there could be additional installation costs for cables that pass through an MCZ. Centrica anticipates that there could be additional vessels restrictions in MCZs including seasonal closures and restricted working times (due to noise and disturbance etc.) during construction and during operation and maintenance. It is concerned that there could be knock-on delays to modification applications to the National Grid if the EIA is delayed or requires extra surveys, modelling or assessment. Centrica also anticipates additional costs for the EIA that supports the re-powering and decommissioning plans, although it is acknowledged that this cost would take place outside the IA 20-year period of analysis. (Centrica, pers. comm., 2011). Centrica has requested that this site-specific cost is kept confidential. However, it is included in national and regional summaries of impact on the sector in the Evidence Base and Annex F respectively.

Table 2d. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 3, North St George's Channel**
Cables (interconnectors and telecom cables) Future interconnectors and telecom cables may pass through the rMCZ. Impacts of rMCZs on future interconnectors and telecom cables are assessed in the Evidence Base, Annex H6 and Annex N3 (they are not assessed for this site alone). **Oil and gas related activities (including carbon capture and storage)** This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 3, North St George's Channel**
Existing cables (interconnectors and telecom cables), recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 3, North St George's Channel**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Fishing vessels are known to use bottom trawls, dredges, pots and traps, seine nets, mid-water trawls, long lines and gill nets in the site. They target primarily *Nephrops* but also scallops, whelks, shrimps, whitefish, herrings, haddock, plaice, brill, lobsters, skates and rays, turbot, monkfish, spurdog and dogfish. The rMCZ covers part of some of the few remaining seine net fishing grounds in the Irish Sea. See Table 2. Subtidal gravel and sand sediments are important as nursery areas for	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result Eof reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawling and dredging and also hooks and lines, nets, and pots and traps to varying degrees. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough,	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 3, North St George's Channel**
fish such as plaice (*Pleuronectes platessa)* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Biogenic reefs provide habitat for shellfish and fish, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)). Ross worm *S. spinulosa* reefs support crevice-dwelling animals such as large crabs and lobsters as well as the queen scallop *Aequipecten opercularis* (Hill and others (1998) and references therein; in Fletcher and others (2012)). They can also support the spat of bivalves such as scallops (OSPAR (2008) in Fletcher and others (2012)). Scallop and queen scallop dredging is carried out in locations of *M. modiolus* reefs (Holt and others (1998) in Fletcher and others (2012)), for example off the south-east coast of the Isle of Man. It is also likely that young Atlantic cod *Gadus morhua* seek *M. modiolus* beds for food and refuge (Hiscock & Marshall (2006) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site (that provide this service) when in an unfavourable condition.	2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The proposed fishing gear restrictions in the site could potentially open up opportunities for static gear fisheries in the site (if they are not being managed) (see Annex L). There may be benefits for mid-water trawlers which will be allowed to continue fishing in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 3, North St George's Channel**
Baseline	**Beneficial impact**	
Recover: ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Subtidal biogenic reefs play a major role in the global carbon cycle and are a major store of carbon (Fletcher and others (2012)). They play a key role in organic matter processing and nutrient cycling at the water–sediment interface (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). Subtidal biogenic reefs also filter large volumes of water (Dubois (2006) in Fletcher and others (2012)) and this helps to purify water of contaminants.	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawling and dredging and also hooks and lines, nets, and pots and traps to varying degrees. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007);	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 3, North St George's Channel**
Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Horse mussel beds are extremely rich; for example 270 invertebrate species were found with horse mussel beds off the north-east of the Isle of Man (OSPAR (2008) in Fletcher and others (2012)). Because of the abundant epifauna and infauna, horse mussel beds have been considered to support one of the most diverse sublittoral communities in north-west Europe (Holt and others (1998) in Fletcher and others (2012)). Threads secreted by horse mussel beds have an important stabilising effect on the sea bed, binding together living matter with dead shell and sediments (Fletcher and others (2012)). Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (McManus (2001); Riding (2002); both in Fletcher and others (2012)).	Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 3, North St George's Channel**
Maintain: At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in feature condition and management of human activities is expected and therefore no benefit to the regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⟺ Confidence: Moderate

Table 4c. Research and education		**rMCZ 3, North St George's Channel**
Baseline	**Beneficial mpact**	
Numerous surveys have been undertaken in parts of the site associated with the proposed Round 3 (Zone 9) wind farm area of search and various cable developments. This comprises benthic surveys, fisheries surveys, acoustic surveys etc. Rees (2005, in ISCZ, 2011) has studied the horse mussel beds in this part of the Irish Sea. The Joint Nature Conservation Committee (JNCC (2011) in ISCZ, 2011) has researched the Croker Carbonate Slabs in the site which are a recommended SAC.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ 3, North St George's Channel**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 4, Mid St George's Channel — Site area (km^2): 760.86

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 4, Mid St George's Channel**

1a. Ecological description

This site is located approximately 23km offshore from the coast of mid-Wales. It is situated between Irish offshore waters to the west and Welsh territorial waters to the east. The depth of the site ranges from 60 metres to125 metres. The sea bed type is predominantly subtidal coarse sediment, but there are also areas of subtidal mixed sediments, sand and bedrock (Dalkin (2008) in ISCZ, 2011). The subtidal bedrock, namely cobbles and boulders, is of ecological importance because it supports a diverse animal community. Barnacles and worms, including *Pomatoceros triqueter*, were found within the offshore circalittloral coarse sediment, while the subtidal mixed sediments contained pebbles, cobbles and boulders that were home to a diverse range of fauna, including barnacles, hydroids, anemones and sponges, for example, dead man's fingers (Dalkin and others (2008) in ISCZ, 2011). Sand and gravel sediments are the most common habitat types found in the site and these are host to a range of different invertebrate species. Within and around rMCZ 4, annelids, worms and crustacean species are the main secondary producers in the food web (Bolam and others (2010) in ISCZ, 2011). These species, which live within or on the sea bed, play a key role in recycling organic matter within the sediment and linking the primary production (in the plankton) with predatory fish.

In addition, this site covers an area of high primary productivity, due to the thermal fronts which commonly form in this location (Miller and others (2010) in ISCZ, 2011). An increase in solar energy during spring causes the relatively warm, less dense, water to sit on top of colder, denser, deep water. This increase in temperature triggers an increase in biological productivity, similar to the increase in productivity later on in the year when water cooling allows for nutrient-rich deeper waters coming in from the Atlantic to mix with the surface waters (Brown and others (2010) in ISCZ, 2011). This indicates the importance of this site for general ecosystem processes, as an increase in primary production attracts herbivorous species and, in turn, larger marine predators to the area. Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. St George's Channel is a key part of their migratory route, utilising the nutrient-rich waters formed by tidal mixing currents (Stephan and others (2011) in ISCZ, 2011).

Recommended MCZ 4 is an important area for sea birds in the Irish Sea, providing a foraging ground for a wide range of species including: guillemots *Uria aalge*, gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus* and puffins *Fratercula arctica*. These birds can have significant foraging radii (the gannet can travel up to 300km) and originate from Welsh and Irish colonies, in particular Cardigan Bay and the rocky cliffs on the east coast of Ireland (RSPB, pers comm., 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The north-eastern section of the site, which contains a productive pelagic front, is heavily used by a number of species. These species utilise the rMCZ and, in particular, the sandy and mixed habitats within it to feed. Locally, guillemots *Uria aalge* feed on sand eels, herrings and sprats; puffins *Fratercula arctica* feed on sand eels and capelins; gannets *Morus bassanus* feed on mackerel, herrings and sand eels; and Manx shearwaters *Puffinus puffinus* feed on herrings, sprats, whitebait and pilchards (RSPB, pers comm., 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point	Baseline	Impact of MCZ

		records		
Broad-scale Habitats				
Moderate Energy Circalittoral Rock	26.67	-	Favourable condition	Maintain at favourable condition
Subtidal Coarse Sediment	368.21	-	Unfavourable condition	Recover to favourable condition
Subtidal Mixed Sediment	246.29	-	Unfavourable condition	Recover to favourable condition
Subtidal Sands	114.41	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Subtidal Sands and Gravels	761.63	2	Unfavourable condition	Recover to favourable condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries	**rMCZ 4, Mid St George's Channel**
Source of costs of the rMCZ The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, dredges, nets, hooks and lines, and pots and traps will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the Impact Assessment (IA) for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range. ***Management scenario 1:*** Entire rMCZ is open to all gear types. ***Management scenario 2:****** Closure of entire rMCZ to bottom trawls. ***Management scenario 3:*** Closure of entire rMCZ to bottom trawls, dredges, nets, hooks and lines, and pots and traps. * This is the management scenario identified by the vulnerability assessment using information collected from stakeholders.	
Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit . A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), fewer than 5 vessels are known to fish in this site (both under and over 15 metre vessels) (ISCZ, 2010). These vessels use dredges, hooks and lines and nets (ISCZ, 2010). Relative to other rMCZs, very little UK fishing activity is known to take place in this site. Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). From Vessel Monitoring System (VMS) data for over 15 metre UK vessels, UK vessels are known to use bottom trawls, hooks and lines, mid-water trawls, and pots and traps in the site but effort is minimal (MMO, 2011a). A Welsh scallop fisher reported that up to 10 dredgers may fish in the site, but that this is less than 5% of their total effort. The estimated total value of UK landings from the site is <£0.001m/yr. This is provided for each affected gear type below.	
Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: The only evidence of bottom trawling in this site is from VMS data for over 15 metre UK vessels	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th colspan="2">rMCZ 4, Mid St George's Channel</th></tr>
<tr><td>(MMO, 2011a). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2"><table><tr><td>Value of landings affected</td><td>0.000</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Dredges: Fewer than 5 UK vessels are known to dredge in the site. These are Scottish vessels targeting scallops from December to June (ISCZ, 2010). They are associated with the home port of Kirkcudbright (ISCZ, 2010). There is no evidence from VMS data (for over 15 metre UK vessels) that this activity takes place in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Nets: Fewer than 5 UK vessels are known to use nets in the site. These are Welsh vessels using gill nets to target pollack. The times of year are not known. They are associated with the home port of Milford Haven (ISCZ, 2010). There is no evidence from VMS data (for over 15 metre UK vessels) that this activity takes place in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Hooks and lines: Fewer than 5 UK vessels are known to use nets in the site. These are Welsh vessels using drift nets to target thornback ray, spurdog and dogfish all year round. They are associated with the home port of Holyhead (ISCZ, 2010). There is evidence from VMS data (for over 15 metre UK vessels) that this activity takes place in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Pots and traps: The only evidence of the use of pots and traps in this site is from VMS data for over 15 metre UK vessels (MMO, 2011a). Stakeholder meetings gave</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr></table></td></tr>
</table>

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ 4, Mid St George's Channel</th></tr>
<tr><td>no indication of this activity taking place in the site (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is <£0.001m/yr.</td><td><table><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td><0.001</td><td><0.001</td></tr><tr><td>GVA affected</td><td>0.000</td><td><0.001</td><td><0.001</td></tr></table>Fewer than 5 vessels are known to fish in the site, using hooks and lines, dredges and nets (ISCZ, 2010). VMS data indicate that bottom trawls, pots and traps, and hooks and lines are used in the site. Discussions at stakeholder meetings indicated that UK fishing activity in the site is very low (Stakeholder Focus Meeting, 2011).
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: < 5
Scenario 3: < 5</td></tr>
<tr><th>Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td>Belgian beam trawlers are known to fish in the site (MMO, 2011a; Belgian Fisheries Representative, 2011). There are usually no more than three Belgian beam trawlers in the entire Irish Sea at one time but, a total of about eight visit the Irish Sea. (Belgian Fisheries Representative, 2011). The Belgian vessels visit the Irish Sea from October to April.
VMS data indicate that Irish dredgers (over 15 metre non-UK vessels) are active in the site but it does not appear to be one of their main grounds. There is no other evidence of non-UK vessel activity in the site (MMO, 2011a).
There is no VMS data evidence that the French fleet is active in the site. However, data provided by Direction des Pêches Maritimes et de l' Aquaculture (2011)</td><td>Comments from representatives of Belgian fisheries: Regarding Scenarios 2 and 3: In the view of Belgian fisheries representatives, the proposed restrictions would be a financial 'disaster' for the Belgian fleet and they anticipate that eight Belgian vessels that currently fish in the Irish Sea would be forced to leave the fishing industry. Displacement of effort of Belgian vessels that fish in the site will increase the concentration of vessels into smaller areas, which will increase competition. If fishing grounds are reduced in area, it is anticipated that fishing quota will also be restricted with significant financial repercussions for the Belgian fishing fleet. The Belgian fleet is gradually adopting a new gear type, the Sumwing, which is a lighter gear and impacts the sea bed less. However, if this gear type is prohibited also in the rMCZ, there would be no alternative but for the Belgian vessels to stop fishing in the Irish Sea and potentially stop fishing altogether. It is not feasible for Belgian vessels to adapt to pots and traps to fish in the Irish Sea. (Belgian Fisheries Representative, 2011). Quantitative estimates of impact are not available.
The Irish and French fleets have not provided qualitative descriptions of impact. Quantitative estimates of impact are not available for the Irish fleet. The impact on the French fleet is estimated to be a loss of in value of landings of <£0.001m/yr for mobile gear (Direction des Pêches Maritimes et de l' Aquaculture, 2011). However, no breakdown of this estimate is available by gear and so it may include the value of landings from mobile gear other</td></tr>
</table>

Table 2a. Commercial fisheries	**rMCZ 4, Mid St George's Channel**
indicates that there is a low value of landings from French vessels from the site for mobile gear (<£0.001m/yr) and for pots and traps (<£0.001m/yr).	than bottom trawling, which would not be affected by Scenarios 1 and 2.

Table 2b. National defence	**rMCZ 4, Mid St George's Channel**
Source of costs of the rMCZ	
Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of the whole site as a firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 4, Mid St George's Channel**
Oil and gas related activities (including carbon capture and storage)	
This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 4, Mid St George's Channel**
Recreation and shipping.	

Table 4. Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ 4, Mid St George's Channel**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).Very little fishing is known to take place in the site. However, there is some evidence of UK vessels using bottom trawls, dredges, mid-water trawls, hooks and lines, nets and pots and traps. Belgian beam trawlers are known to fish in the site (MMO, 2011a; Belgian Fisheries Representative, 2011). See Table 2 for more detail. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawls and/or dredges, and to nets, hooks and lines, and pots and traps to varying degrees. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. There may be benefits for mid-water trawlers and static gear vessels (if not being managed) which will be allowed to continue fishing in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services	**rMCZ 4, Mid St George's Channel**	
Baseline	**Beneficial impact**	
Recover: ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawls and/or dredges, and to nets, hooks and lines, and pots and traps to varying degrees. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 4, Mid St George's Channel**
resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. **Maintain:** At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in feature condition and management of human activities is expected and therefore no benefit to the regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⟺ Confidence: Moderate

Table 4c. Research and education		**rMCZ 4, Mid St George's Channel**
Baseline	**Beneficial impact**	
The level of research undertaken in the site is unknown.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ 4, Mid St George's Channel**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 5, North of Celtic Deep — Site area (km^2): 655.69

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 5, North of Celtic Deep**

1a. Ecological description

This site is a large offshore area located between Welsh territorial waters and Irish offshore waters. It is the most southerly site in the ISCZ Project Area, located 23km from the Welsh coast. Extensive areas of subtidal coarse sediment are present throughout the site in addition to subtidal sand and moderate energy rocky habitat. The site includes part of St George's Channel, which is a deep (c.112 metres) area that connects the Irish Sea to the Celtic Sea ands through which water enters the Irish Sea from the Atlantic Ocean. The area is associated with high benthic diversity (Bolam and others (2010) in ISCZ 2011) and high pelagic biological productivity due to thermal fronts that form in the summer months (Miller and others (2010) in ISCZ, 2011). The associated increase in abundance of pelagic food attracts top predators; the area is critical to the common dolphin (Clark and others (2010) in ISCZ, 2011) and is an important sea bird foraging area (Smith and others (2011) in ISCZ, 2011). Gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus* and puffins *Fratercula arctica* are likely to forage in the area and originate from Welsh and Irish colonies, in particular Cardigan Bay and the rocky cliffs on the east coast of Ireland (RSPB, pers comm., 2011). Gannets feed on mackerel, herring and sand eels; Manx shearwaters feed on herrings, sprats, whitebait and pilchards; and puffins feed on sand eels and capelins (RSPB, pers comm., 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).

Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. St George's Channel is a key part of their migratory route, utilising the nutrient-rich waters formed by tidal mixing currents (Stephan and others (2011) in ISCZ, 2011). Molluscs and annelids (for example, bivalves and worms) along with crustaceans are the main secondary producers around the area of rMCZ five (Bolam and others (2010) in ISCZ, 2011), which means these marine animals are important for recycling organic matter from within the sediment and are key in linking energy between primary production in the plankton with predatory fish (Bolam and others (2010) in ISCZ, 2011). The ocean quahog *Arctica islandica* has been recorded within rMCZ five (Mackie (1995) in ISCZ, 2011). The only known breeding population of quahogs in the Irish Sea is located much further north (in rMCZ 6), as the warmer sea water temperatures in recent years may not favour larval survival in the southern Irish Sea (P. Butler, pers comm., 2011). However, given the longevity of the species and its importance as a scientific reference tool, the ocean quahog is noted as being present but not designated in this southerly site, rMCZ 5. There are records for horse mussels *Modiolus modiolus*, a feature which has not proposed for designation in this site. The records within rMCZ five are likely to be scattered populations of adults, records of juveniles, or another *modiolus* species (Rees (2005) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Moderate Energy Circalittoral Rock	2.33	-	Favourable condition	Maintain at favourable condition
Subtidal Coarse Sediment	616.83	-	Unfavourable condition	Recover to favourable condition

Subtidal Sands	32.62	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Subtidal Sands and Gravels	599.86	3	Unfavourable condition	Recover to favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries **rMCZ 5, North of Celtic Deep**

Source of costs of the rMCZ

The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, dredging, nets, hooks and lines will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the Impact Assessment (IA) for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range.

Management scenario 1: Entire rMCZ is open to all gear types.

Management scenario 2:*** Closure of entire rMCZ to bottom trawls.

Management scenario 3: Closure of entire rMCZ to bottom trawls, dredges, nets, and hooks and lines.

* This is the management scenario identified by the vulnerability assessment using information collected from stakeholders.

Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit . A number of commercial fishing restrictions are already in existence (listed in Annex E). Relatively speaking, very little UK fishing activity is known to take place in the site. Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area, fewer than 5 UK vessels are known to fish in the site (both under and over 15 metre vessels) (ISCZ, 2010). These use dredges, long lines and gill nets and are Scottish and Welsh vessels (ISCZ, 2010). Discussions at stakeholder meetings indicated that UK fishing activity in the site is very low (Stakeholder Focus Meeting, 2011). Vessel Monitoring System (VMS) data suggest that bottom trawls, nets, and hooks and lines are used by over 15 metre UK vessels in the site but that effort is very low. There is no evidence for the use of pots and traps or mid-water trawls in the site. The site is mostly fished by non-UK vessels (see below).

The estimated total value of UK landings from the site is <£0.001m/yr.

Baseline description of UK commercial fisheries

Bottom trawls: VMS data indicates that bottom trawling by over 15 metre UK vessels takes place in this site (MMO, 2011a). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011).

The estimated value of landings from the site is <£0.001m/yr.

Costs of impact of rMCZ on UK commercial fisheries

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2	Scenario 3
Value of landings affected	0.000	<0.001	<0.001

Stakeholders have not provided a description of impact.

Dredges: Fewer than 5 UK vessels are known to dredge in the site (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2	Scenario 3
Value of landings affected	0.000	0.000	<0.001

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th>rMCZ 5, North of Celtic Deep</th></tr>
<tr><td colspan="2">(Stakeholder Focus Meeting, 2011). VMS data does not indicate the use of dredges by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Nets: Fewer than 5 UK vessels are known to use nets in the site (ISCZ, 2010). They are Welsh vessels using gill nets to target pollack. VMS data indicate the use of nets by over 15 metre UK vessels in the site (MMO, 2011a). Discussions at stakeholder meetings indicated that the level of UK fishing activity in the site is very low (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Hooks and lines: Fewer than 5 vessels are known to use nets in this site. They are Welsh vessels, using long lines to target spurdog, catfish, dogfish and thornback ray throughout the year (ISCZ, 2010). Discussions at stakeholder meetings indicated that UK fishing activity in the site is very low (Stakeholder Focus Meeting, 2011). VMS data indicate that hooks and lines are used by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="3">Total direct impact on UK commercial fisheries</td></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td><0.001</td><td><0.001</td></tr><tr><td>GVA affected</td><td>0.000</td><td><0.001</td><td><0.001</td></tr></table>Fewer than 5 vessels are known to fish in the site using hooks and lines, dredges and nets (ISCZ, 2010). VMS data indicate that bottom trawls, nets, and hooks and lines are used in the site. Discussions at stakeholder meetings indicated that UK fishing activity in the site is very low (Stakeholder Focus Meeting, 2011).
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: < 5
Scenario 3: < 5</td></tr>
</table>

Table 2a. Commercial fisheries	**rMCZ 5, North of Celtic Deep**
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
VMS data indicate that Belgian, Spanish and French bottom trawlers and Belgian beam trawlers fish (all over 15 metre vessels) fish in the site (MMO, 2011a). There are usually no more than three Belgian beam trawlers in the entire Irish Sea at one time but, a total of about eight visit the Irish Sea. (Belgian Fisheries Representative, 2011). The Belgian vessels visit the Irish Sea from October to April. The estimated value of French landings from the site is £0.021m/yr for mobile gear (Direction des Pêches Maritimes et de l' Aquaculture, 2011).	***Comments from representatives of Belgian fisheries:*** *Regarding Scenarios 2 and 3:* In the view of Belgian fisheries representatives, the proposed restrictions would be a financial 'disaster' for the Belgian fleet and they anticipate that eight Belgian vessels that currently fish in the Irish Sea would be forced to leave the fishing industry. Displacement of effort of Belgian vessels that fish in the site will increase the concentration of vessels into smaller areas, which will increase competition. If fishing grounds are reduced in area, it is anticipated that fishing quota will also be restricted with significant financial repercussions for the Belgian fishing fleet. The Belgian fleet is gradually adopting a new gear type, the Sumwing, which is a lighter gear and impacts the sea bed less. However, if this gear type is prohibited also in the rMCZ, there would be no alternative but for the Belgian vessels to stop fishing in the Irish Sea and potentially stop fishing altogether. It is not feasible for Belgian vessels to adapt to pots and traps to fish in the Irish Sea. (Belgian Fisheries Representative, 2011). Quantitative estimates of impact are not available. The Spanish and French fleets have not provided a description of impact. Quantitative estimates of impact are not available for the Spanish and Belgian fleet. The impact on the French fleet is estimated to be a loss in value of landings of £0.021m/yr for mobile gear (Direction des Pêches Maritimes et de l' Aquaculture, 2011). However, no breakdown of this estimate is available by gear and so it may include the value of landings from mobile gear other than bottom trawling which would not be affected.

Table 2b. National defence	**rMCZ 5, North of Celtic Deep**
Source of costs of the rMCZ	
Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of the whole site as a firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 5, North of Celtic Deep**
Oil and gas related activities (including carbon capture and storage) This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H10 and Annex N9 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 5, North of Celtic Deep**
Existing cables (telecom cables), recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 5, North of Celtic Deep**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).UK fishing activity in the site is very low. However, there is some evidence of UK fishing vessels using bottom trawls, nets, and hooks and lines in the site. Belgian, Spanish and French bottom trawlers are known to fish in the site. See Table 2 for more detail. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawls, dredges and to nets and hooks and lines to varying degrees. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. There may be benefits for mid-water trawlers and static gear vessels (if it is not being managed) which will be allowed to fish in the site but there is currently no	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption	**rMCZ 5, North of Celtic Deep**	
	evidence to support or refute this. Nor is there any evidence of mid-water trawling currently taking place in the site. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	

Table 4b. Regulating services	**rMCZ 5, North of Celtic Deep**	
Baseline	**Beneficial impact**	
Recover: ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawls, dredges and to nets and hooks and lines to varying degrees. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 5, North of Celtic Deep**
Maintain: At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in feature condition and management of human activities is expected and therefore no benefit to the regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⟺ Confidence: Moderate

Table 4c. Research and Education		**MCZ 5, North of Celtic Deep**
Baseline	**Beneficial impact**	
The level of research undertaken in the site is unknown.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ 5, North of Celtic Deep**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 6, South Rigg — Site area (km^2): 146.20

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 6, South Rigg**

1a. Ecological description

Recommended MCZ 6 is located in the western Irish Sea between three different territorial seas: northern Irish waters to the west, Scottish waters to the north and the Isle of Man waters to the east. The depth of the sea bed in the site ranges from 50 metres to 150 metres. This site is largely comprised of subtidal mud which contains sea-pens (specifically the slender sea-pen) and burrowing animals, such as the mud-burrowing shrimp *Callianassa* sp., the commercially important Dublin Bay prawn *Nephrops norvegicus* and the heart urchin *Brissopsis lyrifera* (Briggs and others (2010) in ISCZ, 2011; Marine Institute/AFBI unpublished data).

In addition to the mud habitat and characteristic species, the site contains the North West Irish Sea mounds, an area known to contain bedrock outcrops and reef habitat. The bedrock outcrops support sea anemones, brittle stars, hydroids and bryozoan turf. A small portion of subtidal sand within the site supports possibly the only breeding population of the ocean quahog *Arctica islandica* in the Irish Sea (Butler (2009) in ISCZ, 2011). The ocean quahog is a long-lived bivalve which, like trees, deposits an annual growth ring, the width of which can be used as a proxy for environmental conditions. Its shell material is an important palaeoclimatic tool that can be used to study the history of changes in sea temperature and other marine environmental variables on multi-centennial timescales (Butler (2009) in ISCZ, 2011).

The deep water, low energy conditions in this site lead to a seasonal cyclonic gyre (i.e. a vortex or rotating body of water) during the summer and spring months, which physically contain *Nephrops* and pelagic juvenile fish larvae within the western Irish Sea (Horsburgh and others (2000) in ISCZ, 2011). The site also contains a productive pelagic front which is heavily used by a number of species. It is an important foraging area for sea birds in the Irish Sea, including guillemots *Uria aalge*, gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus*, razorbills *Alca torda* and puffins *Fratercula arctica*. The birds probably originate from Manx (Isle of Man) and Irish colonies (RSPB, pers comm., 2011). Guillemots) feed on sand eels, herrings and sprats; puffins feed on sand eels and capelins; gannets feed on mackerel, herrings and sand eels; Manx shearwaters feed on herrings, sprats, whitebait and pilchards; and razorbills feed on sand eels, herrings and sprats (RSPB, pers comm., 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	96.28	-	Unfavourable condition	Recover to favourable condition
Low Energy Circalittoral Rock	21.09	-	Unfavourable condition	Recover to favourable condition
Subtidal Sand	28.83	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Deep Water Mud Habitats	42.07	1	Unfavourable condition	Recover to favourable condition
Species of Conservation Importance				

Sea-pen and Burrowing Animals Communities	-	2	Unfavourable condition	Recover to favourable condition
Ocean Quahog	-	59	Unfavourable condition	Recover to favourable condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 6, South Rigg**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Two vessels are recorded to have wrecked in the site (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Commercial fisheries	**rMCZ 6, South Rigg**
Source of costs of the rMCZ The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, dredging, hooks and lines will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the Impact Assessment (IA) for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range. ***Management scenario 1:*** Entire rMCZ is open to all gear types. ***Management scenario2:****** Closure of entire rMCZ to bottom trawls (excluding seine nets) and dredges. ***Management scenario 3:******** Closure of entire rMCZ to bottom trawls, dredges, and hooks and lines. * This is the management scenario identified by the vulnerability assessment using information collected from stakeholders. ** Natural England and the JNCC advise that hooks and lines need to be managed only in the vicinity of Low Energy Circalittoral Rock but, for ease of analysis, the loss of landings estimate represents the loss of landings from the entire rMCZ.	
Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit . A number of commercial fishing restrictions are already in existence	

Table 2b. Commercial fisheries **rMCZ 6, South Rigg**

(listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), at least 39 vessels are known to fish in the site (both under and over 15 metre vessels) (ISCZ, 2010). However, stakeholders have indicated that around 95 vessels are likely to fish in this site (ANIFPO, 2011; NIFPO, 2011). The site is in the most intensely fished part (in terms of effort and landings value) of the ISCZ Project Area (MMO, 2011a). The site is part of the largest nephrops fishing ground (in terms of area) in the ISCZ Project Area, and as such is very important in terms of landings to the Northern Irish fleet (ISCZ, 2010), in particular to vessels from the port of Portavogie but also Ardglass and Kilkeel (NIFPO, pers. comm., 2011). While mainly bottom trawls (twin and single-rig otter trawls) are used in the site, mid-water trawls and dredges are also used (ISCZ, 2010). Vessel Monitoring System (VMS) data indicate the use of hooks and lines in the site (MMO, 2011a). There is no evidence of fishing activity using nets or pots and traps in the site. The estimated total value of UK landings from the site is £1.253m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: Approximately 95 vessels are thought to use bottom trawls (twin and single-rig otter trawls and pair trawls) in the site (ANIFPO, 2011; NIFPO, 2011). At least 32 vessels are known to use bottom trawls in the site (ISCZ, 2010). They target primarily nephrops throughout the year (mainly February to April) but also shrimp, cod, haddock, pollack, whitefish and scallop (ISCZ, 2010). These vessels are associated with the port of Portavogie but also Ardglass and Kilkeel (ISCZ, 2010). VMS data indicate a high degree of bottom trawling effort by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £1.019m/yr.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 1.019 | 1.019 ***Comments from representatives of the Northern Ireland fishing fleet:*** *Regarding Scenarios 2 and 3:* Northern Irish fisheries anticipate that rMCZ 6 will displace their bottom trawlers into fewer and smaller fishing grounds (south of rMCZ 7). They estimate that at least 45 vessels are likely to be affected. These vessels are mostly associated with Portavogie but also Kilkeel and Ardglass. They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation. This site is important as good quality nephrops for the 'whole' market are fished from the site. Whole nephrops obtain a higher price per tonne compared with nephrops 'tails' which are sole for processing into products such as scampi. Whole nephrops are mostly sold abroad as it is popular on the continent to eat them whole. As such, the landings estimate for bottom trawling for this site may not reflect the higher price obtained for whole nephrops compared to tail nephrops. Prohibition of seine netting would result in the only known seine netting vessels (who operate in the ISCZ Project Area) seeking to operate elsewhere. However, with limited fishing grounds it could result in the vessels exiting the industry. (NIFPO, 2011). Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011). Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011;

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries
rMCZ 6, South Rigg</th></tr>
<tr><td></td><td>NIFPO, 2011).
Further detail on impacts to the fisheries sector can be found in Annex J and Annex F.</td></tr>
<tr><td>Dredges: Fewer than 5 vessels are known to dredge (towed and suction gear) in the site for scallop from November to June. These vessels are associated with the home ports of Kilkeel and Kirkcudbright (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data indicate that dredging by over 15 metre UK vessels takes place in the site but that effort is low.
The estimated value of landings from the site is £0.030m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.030</td><td>0.030</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Hooks and lines: VMS data provide the only evidence of the use of hooks and lines in the site. Stakeholder meetings did not indicate the use of hooks and lines in the site.
The estimated total value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Total direct impact on UK commercial fisheries</td></tr>
<tr><td></td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>1.049</td><td>1.049</td></tr><tr><td>GVA affected</td><td>0.000</td><td>0.442</td><td>0.442</td></tr></table>Approximately 95 vessels are thought to use bottom trawls and dredges in the site (ANIFPO, 2011; NIFPO, 2011). At least 39 vessels are known to use dredges and bottom trawls (including seine nets) in the site and so are likely to be affected (ISCZ, 2010). There are VMS data evidence for the use of hooks and lines in the site but the number of vessels is not known (MMO, 2011a).
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: 33–95
Scenario 3: 39–95</td></tr>
</table>

Table 2b. Commercial fisheries	**rMCZ 6, South Rigg**
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
VMS data indicates that Irish vessels (over 15 metre vessels) fish in the site but do not indicate what gear type this is. The degree of fishing effort appears to be very low (MMO, 2011a). Stakeholder meetings gave no indication of how many non-UK vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011).	The Irish fleet has not provided a description of impact. Quantitative estimates are not available.

Table 2c. National defence	**rMCZ 6, South Rigg**
Source of costs of the rMCZ	
Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of the whole site as a submarine exercise area.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2d. Ports, harbours, shipping and disposal sites	**rMCZ 6, South Rigg**
Source of costs of the rMCZ	
Management scenario 1: Not applicable to this site.	
Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Disposal sites: There is one disposal site (Isle of Man Site C) within 5km of the rMCZ. It is not known which ports use this disposal site. No licence applications were received for this disposal site between 2001 and 2010 but it is not closed to	

£m/yr	Scenario 1	Scenario 2
Cost to the operator	0.000	0.000

Scenario 1: Not applicable.

Scenario 2: Although the disposal site rMCZ has not been used in the last ten years, it might be used during the 20

disposal in the future (Cefas, pers. comm. 2011)).	year period covered by the IA. Future licence applications for disposal of material in the disposal site will need to consider the potential effects of the activity on the features protected by the rMCZ. This cost is not quantified.

Table 2e. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 6, South Rigg**
Oil and gas related activities (including carbon capture and storage) This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H10 and Annex N9 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 6, South Rigg**
Cables (existing interconnectors and telecom cables), recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 6, South Rigg**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use dredges, mid-water trawls and hooks and lines to target a number of species (ISCZ, 2010). See Table 2 for more detail. The benthic (bottom dwelling) organisms of this habitat form an important part	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawls, dredges and/or hooks and lines. Therefore there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 6, South Rigg**
of the food chain and transfer organic carbon back into the pelagic (open water) realm (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)). Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). *Arctica islandica* has a range of predators including haddock, ocean pout and various crustaceans (Hill (2010) in Fletcher and others (2012)). It is an important food source for cod *Gadus morhua* (Sabatini (2008) in Fletcher and others (2012)). *Arctica islandica* has also been found in the stomach of North Sea cod (Rees, 1993). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).	could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The proposed fishing restrictions may provide benefits for mid-water trawlers which will be allowed to fish in the site but there is currently no evidence to support or refute this. Nor is there any evidence of mid-water trawling taking place in the site. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 6, South Rigg**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawls, dredges and/or hooks and lines. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 6, South Rigg**
provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to the depth of the water column and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crab, harbour crab, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones,	as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 6, South Rigg**
Hiscock & Connor (2000) in Fletcher and others (2012)).The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**rMCZ 6, South Rigg**
Baseline	**Beneficial impact**	
The Northern Ireland Agri-Food and Biosciences Institute has undertaken various research projects in the site, including mapping of *Nephrops* burrow density. Ocean quahogs have previously been studied (some in the site) to understand ocean conditions and climatic variability (Butler (2009) in ISCZ, 2011). Ocean quahogs are also indicators of heavy metal accumulation in pollutant biomonitoring research (Liehr (2005) in Fletcher and others (2012)) and so the site provides significant research potential due to the limited distribution of ocean quahogs in the Irish Sea.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ, 6 South Rigg**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 7, Slieve Na Griddle — Site area (km^2): 57.79

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 7, Slieve Na Griddle**

1a. Ecological description

This site is located in the western Irish Sea between Northern Irish territorial waters to the west and Manx territorial waters to the east. Subtidal mud and bedrock habitats make up the sea bed types in the site and the depth ranges from 70 metres to 150 metres. The Pisces Reef complex (comprised of low energy circalittoral rock) falls partly within the boundary of the site; the reef qualifies as an Annex 1 reef habitat according to the EC Habitats and Species Directive and has been formally recommended as a Special Area of Conservation (SAC). The Pisces Reef is comprised of three bedrock pinnacles which rise 15–35 metres from the surrounding sea bed, although not all of these are located within the site. The reefs support a diverse animal community, including hydroids (e.g *Diphasia nugra*), a range of sponges, including the cup sponge *Axinella infundibuliformi*, echinoderms, for example the cushion starfish *Porania pulvillus* and various crustaceans, for example the edible crab *Cancer pagurus* and squat lobster *Munida rugosa*. Additionally, the reef may provide shelter for juvenile fish, including blue whiting, bib, red gurnard and wrasse (Judd (2004) in ISCZ, 2011).

The low energy mud habitat in this region (Horsburgh and others (2000) in ISCZ, 2011) supports a thriving and commercially important Dublin Bay prawn *Nephrops norvegicus* fishery. The *Nephrops* fishery is particularly important since the collapse and decline of cod and whiting fisheries in the region and, based on fishery independent video survey data (between 2003 and 2007), it appears that *Nephrops* burrows are decreasing in density (Clements (2010) in ISCZ, 2011). Close to the Pisces Reef, the soft sediment in which the *Nephrops* burrow is inaccessible to traditional fishing methods and, as such, the reef provides a natural refuge from fishing pressure. During submersible trials in the 1970s, scattered sea-pens were recorded in the soft sediments between rocky outcrops of the Pisces Reef, but they are no longer present in the same abundance (JNCC (2011) in ISCZ, 2011).

Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. It was found that the area is used significantly by basking sharks during the months of July to September utilising the nutrient-rich stratified waters between the Isle of Man and Northern Ireland (Stephan and others (2011) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	53.34	-	Unfavourable condition	Recover to favourable condition
Low Energy Circalittoral Rock	4.18	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Deep Water Mud Habitats	57.76	1	Unfavourable condition	Recover to favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 7, Slieve Na Griddle**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
There are 3 wrecks recorded in this site, 2 of which are thought to be British motorised fishing vessels (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Commercial fisheries	**rMCZ 7, Slieve Na Griddle**
Source of costs of the rMCZ The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, dredges and the use of hooks and lines will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the IA for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range. ***Management scenario 1:*** Entire rMCZ is open to all gear types. ***Management scenario 2:***** Closure of entire rMCZ to bottom trawls. ***Management scenario 3:****** Closure of entire rMCZ to bottom trawls, dredges, pots and traps, and hooks and lines. * This is the management scenario identified by the vulnerability assessment using information collected from stakeholders. ** Natural England and the JNCC advise that hooks and lines need to be managed only in the vicinity of Low Energy Circalittoral Rock but, for ease of analysis, the loss of landings estimate represents the loss of landings from the entire rMCZ.	
Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), Northern Ireland fisheries feel that about 40 UK vessels fish in this site (ANIFPO, 2011; NIFPO, 2011). This corroborates with the 37 vessels who have indicated that they fish there (both under and over 15 metre vessels) (ISCZ, 2010). The site is part of the largest nephrops fishing ground (in terms of area) in the ISCZ Project Area, and as such is very important in terms of landings to the Northern Irish fleet (ISCZ, 2010), in particular to vessels from the port of Ardglass (NIFPO, pers. comm., 2011). While mainly bottom trawls (twin and single-rig otter trawls) are used in the site, mid-water trawls are also used. Vessel Monitoring System (VMS) data indicate the use of hooks and lines, bottom trawls and mid-water trawls in the site. There is no evidence of dredging or nets in the site. The estimated total value of UK landings from the site is £0.558m/yr (MCZ	

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries rMCZ 7, Slieve Na Griddle</th></tr>
<tr><td colspan="2">Fisheries Value Model). This is provided for each affected gear type below.</td></tr>
<tr><th>Baseline description of UK commercial fisheries</th><th>Costs of impact of rMCZ on UK commercial fisheries</th></tr>
<tr><td>Bottom trawls: Up to 40 UK vessels are thought to use bottom trawls (twin and single-rig otter trawls and pair trawls) in the site (ANIFPO, 2011; NIFPO, 2011). At least 31 UK vessels are known to use bottom trawls in the site (ISCZ, 2010). They target primarily nephrops throughout the year but also shrimp, cod, haddock, pollack and whitefish. These vessels are associated with the home ports of Kilkeel, Ardglass and Portavogie. VMS data indicates a high degree of bottom trawl effort by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.539m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.539</td><td>0.539</td></tr></table>Comments from representatives of the Northern Ireland fishing fleet: Regarding Scenarios 2 and 3: Northern Irish fisheries anticipate that rMCZ 7 will displace their bottom trawlers into fewer and smaller fishing grounds (south of rMCZ 7). They estimate that at least 30 to 40 vessels are likely to be affected. These vessels are mostly associated with Ardglass. They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation.
Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011; NIFPO, 2011).
Further information on the impacts can be found in Annex J.</td></tr>
<tr><td>Dredges: There is no evidence for dredging in this site (ISCZ, 2010; MMO, 2011a).
The estimated value of landings from the site is £0.011m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td>0.011</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Hooks and lines: VMS data indicates the use of hooks and lines by over 15 metre UK vessels in the site. Stakeholder meetings have provided no indication of this activity in the site (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Pots and traps: VMS data indicates the use of pots and traps by over 15 metre UK vessels in the</td><td>The annual value of UK landings affected is estimated to fall within the following range:</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th colspan="2">rMCZ 7, Slieve Na Griddle</th></tr>
<tr><td>site. Stakeholder meetings have provided no indication of this activity in the site (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is £0.002m/yr.</td><td colspan="3"><table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td>0.002</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><th colspan="4">Total direct impact on UK commercial fisheries</th></tr>
<tr><td></td><td colspan="3">The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.539</td><td>0.553</td></tr><tr><td>GVA affected</td><td>0.000</td><td>0.216</td><td>0.222</td></tr></table>Up to 40 UK bottom trawlers (twin and single-rig otter trawls and pair trawls) are anticipated to be affected (ANIFPO, 2011; NIFPO, 2011). At least 37 UK vessels are known to fish in the site and so will be affected (ISCZ, 2010).
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: 31–40
Scenario 3: 37–40</td></tr>
<tr><th>Baseline description of non-UK fisheries</th><th colspan="3">Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td>VMS data provides no indication of fishing by over 15 metre non-UK vessels in the site. Neither do discussions with stakeholders.</td><td colspan="3">None.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2c. National defence</th><th>rMCZ 7, Slieve Na Griddle</th></tr>
<tr><td colspan="3">Source of costs of the rMCZ
Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.</td></tr>
<tr><th>Baseline description of activity</th><th colspan="2">Costs of impact of rMCZ on the sector</th></tr>
<tr><td>The Ministry of Defence is known to make use of the whole site as a submarine exercise area.</td><td colspan="2">It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.</td></tr>
</table>

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 7, Slieve Na Griddle**
Cables (interconnectors and telecom cables) Future interconnectors and telecom cables may pass through the rMCZ. Impacts of rMCZs on future interconnectors and telecom cables are assessed in the Evidence Base, Annex H6 and Annex N3 (they are not assessed for this site alone). **Oil and gas related activities (including carbon capture and storage)** This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 7, Slieve Na Griddle**
Ports, harbours, shipping and disposal sites; and recreation.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 7, Slieve Na Griddle**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use mid-water trawls and hooks and lines to target a number of species (ISCZ, 2010). More detail is provided in Table 2. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into pelagic (open water) layers (Snelgrove (1999) in Fletcher and others	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawls, dredges and/or hooks and lines. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 7, Slieve Na Griddle**
(2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals (found in subtidal mud and deep water habitats) are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).	the value to fishing vessels of this potential spill-over effect. The proposed fishing restrictions may provide benefits for mid-water trawlers which will be allowed to fish in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ 7, Slieve Na Griddle**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawls, dredges and/or hooks and lines. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 7, Slieve Na Griddle**
(Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to the depth of the water column and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crab, harbour crab, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals (found in subtidal mud and deep water habitats) are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).		

Table 4c. Research and education	**rMCZ 7, Slieve Na Griddle**	
Baseline	**Beneficial impact**	
The Northern Ireland Agri-Food and Biosciences Institute has undertaken various research projects in this area of the Irish Sea, including mapping of *Nephrops* burrow density. The Joint Nature Conservation Committee (JNCC (2011) in ISCZ, 2011) has researched the Pisces Reef in the site, which is a recommended Special Area of Conservation (SAC).	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ 7, Slieve Na Griddle**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs).. Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 8, Fylde Offshore — Site area (km^2): 260.27

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 8, Fylde Offshore**

1a. Ecological description

This site is located in Liverpool Bay, approximately 3.6km off the (Lancashire) Fylde coast. The depth of the sea bed ranges from almost being exposed on a low tide (just 0.35 metres in depth) to 22 metres. The site is located within the Liverpool Bay Special Protection Area (SPA), which is designated to protect the populations of overwintering red throated diver *Gavia stellata* and common scoter *Melanitta nigra* and their supporting habitats. The subtidal sand habitat in this site is of ecological importance due to the high abundance of bivalve species and the high amount of benthic productivity that has been recorded in the site (Kaiser and others (2006) in ISCZ, 2011). Bivalves play a key role in unlocking the energy of primary producers which, in the sea, are the phytoplankton (microscopic algae) and making it available to be used as food by other creatures. As such, primary producers are the very basis of the food chain that provides the fish consumed by humans. The bivalves within rMCZ 8 are suspension filter feeders which live within the sediment itself; they filter suspended particles from the water column (via a siphon which extends up into the water) and discharge nutrient-rich particulates onto the sea bed (Dame (1996) in ISCZ, 2011). Bivalves also perform an important role in regulating and maintaining water quality by filtering suspended sediments and excess, potentially harmful, nutrients (such as nitrates and phosphates).

Animals living in and around sandbanks, such as those found within the site, are varied but include common hermit crabs *Echichthys vipera*, sea stars *Asterias rubens*, flying crabs *Liocarcinus holsatus* and other shrimp-like crustaceans *Mysidacea* (Kaiser and others (2004) in ISCZ, 2011). Around this general area, the distribution and abundance of bivalves is closely linked to the distribution of the common scoter *Melanitta nigra* (Kaiser and others (2006) in ISCZ, 2011). The Centre for Environment, Fisheries and Aquaculture Science (Cefas) has identified that this area is very important as nursery and spawning grounds for several commercially important fish species, including sole, plaice and whiting (Ellis, 2012). Areas where common scoters were recorded in greater numbers generally corresponds with the areas with the highest abundance and biomass of bivalve prey species; this underlines the importance of what is otherwise a very common habitat type in the Irish Sea. The overlapping of the site within Liverpool Bay SPA will provide additional protection to the sea bed features within the rMCZ area. The SPA provides the appropriate protection to overwintering red throated divers and common scoters and their prey and habitats but this may provide only spatial and temporal protection to other sea bed species and habitats which this rMCZ seeks to protect. The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Sand	260.04	-	Favourable condition	Maintain at favourable condition
Habitats of Conservation Importance				
Subtidal Sand and Gravels	199.53	10	Favourable condition	Maintain at favourable condition

1c. Contribution to an ecologically coherent network
To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 8, Fylde Offshore**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Evidence of archaeology is recorded in this site, including the wreck of a Norwegian cargo vessel and possibly a steam trawler. There is also evidence of World War II military aircraft wrecks in the site (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Ports, harbours, shipping and disposal sites	**rMCZ 8, Fylde Offshore**
Source of costs of the rMCZ ***Management scenario 1:*** Not applicable to this site. ***Management scenario 2:*** Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Disposal sites: There is one disposal site within 5km of the rMCZ linked to the port of Preston. No licence applications were received for this disposal site between 2001 and 2010 but it is not closed to disposal in the future (Cefas, pers. comm. 2011)). ***Port Development:*** There is one port within 5km of this rMCZ: Lytham St. Annes. No port developments are known to be planned within the 20 year period of the Impact Assessment (IA).	<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.000</td><td><0.001*</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information.

	Scenario 1*:** Not applicable. ***Scenario 2: Although the disposal site rMCZ has not been used in the last ten years, it might be used during the 20 year period covered by the IA. Future licence applications for disposal of material in the disposal site and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 8, Fylde Offshore**
Oil and gas related activities (including carbon capture and storage) This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 8, Fylde Offshore**
Existing cables (interconnectors and telecom cables), commercial fisheries and recreation.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 8, Fylde Offshore**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Relatively little fishing takes place in the site. Approximately 10 vessels (mostly from ports in north-west England) use bottom trawls to target sole, plaice, prawns, shrimps, skates and rays and flounders. Fewer	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No additional management (above that in the baseline situation) of fishing activities is expected. As such, no benefits are expected to accrue as a result of reduced fishing mortality. No change in on-site feature condition or fishing	Anticipated direction of change: ⟺

Table 4a. Fish and shellfish for human consumption		**rMCZ 8, Fylde Offshore**
than five vessels are known to use static gear (pots and traps; gill, drift and push nets) to target whelks, lobsters, crabs, brill, thornback rays, turbot, monkfish, mullets, bass, Atlantic salmon and shrimps. Fewer than five vessels dredge the area for scallops although this is questioned by NWIFCA who know of no scallop dredging in the area (pers. comm., 2012). The area was once important fishing grounds for the port of Fleetwood; however, very few vessels associated with this port are still active. See Table 2 for more detail. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Cefas sensitivity surveys have identified this area as being very important as nursery and spawning grounds for several commercially important fish species, including sole, plaice, and whiting (Ellis and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	mortality is anticipated and therefore no impact on on-site or off-site benefits is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Confidence: Moderate

Table 4b. Regulating services		**rMCZ 8, Fylde Offshore**
Baseline	**Beneficial impact**	
Maintain: ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in feature condition and management of human activities is expected and therefore no benefit to the regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⇔ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 8, Fylde Offshore**
Environmental resilience: The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**rMCZ 8, Fylde Offshore**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Cefas has conducted research in and around the site into fish spawning and nursery areas (Ellis and others (2012)).	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ 8, Fylde Offshore**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the	Anticipated direction of change: ⇧

Table 4d. Non-use and option values		**rMCZ 8, Fylde Offshore**
	current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of nine members of the public who commented on the potential designation of rMCZ 8, seven said it was a 'good' or 'very good' idea. Reasons stated included the need to conserve and protect marine biodiversity. Two respondents said it is a good thing as long as they do not affect the operation of wind farms.	Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) 10, Allonby Bay — Site area (km^2): 39.06

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 10, Allonby Bay**

1a. Ecological description

This site is situated on the north Cumbrian coast within Allonby Bay. The site extends from the intertidal zone to approximately 5.5km off the coast to a depth of 6 metres and includes a mixture of habitat types. The intertidal area of this site has been surveyed since 1993 by the Cumbria Sea Fisheries Committee (now the North Western Inshore Fisheries and Conservation Authority (NWIFCA)) (Lancaster (2010) in ISCZ, 2011).

The intertidal biogenic reefs, formed of blue mussel *Mytilus edulis* beds and honeycomb worm *Sabellaria alveolata* reefs, are extensive features typical of this part of the Cumbrian shore and are present in good condition within this site (J. Lancaster, pers. comm., 2010). They are the most extensive and best examples in the UK. Also present around the beds are sea lettuce *Ulva intestinalis* and *Ceramium* red algae (Lancaster (2010) in ISCZ, 2011). The honeycomb worm reefs range from 10cm to 60cm in height. Individually, these tube-dwelling worms cement together sand grains to form the structure in which they live. Collectively, these structures support a range of other species. Within rMCZ 10, the following species have been recorded in and around honeycomb worm reefs: breadcrumb sponges *Halichondria panacea*, baked bean ascidians *Dendrodoa grossularia*, kelp, oarweed, sea lettuce *Ulva intestinalis*, sea mats *Membranipora membranacea* and different crab species (Lancaster (2010) in ISCZ, 2011).

Maryport Roads, an area of subtidal coarse sediment that partly falls within this site, was surveyed extensively between the late 1960s and 1980s and has been noted as an area of high biodiversity (e.g. Perkins (1973; 1988) in ISCZ, 2011). It was identified as having an extremely diverse, shallow and cobbley area associated with subtidal mixed sediments. It is extremely productive and diverse with sponges, soft corals such as dead man's fingers *Alyconium digitatum*, bryozoans including hornwrack *Flustra foliacea*, the red sea squirt *Dendrodoa grossularia*, anemones, hydroids and the reef building honeycomb worm *Sabellaria alveolata* (English Nature (1997) in ISCZ, 2011).This area has also been identified by the Regional Stakeholder Group as an important spawning ground for commercial species including skate, thornback ray *Raja clavata* and bass. It is also thought to be an important pupping ground for the harbour porpoise *Phocoena phocoena*.

Intertidal rock is generally colonised by algae in wave-sheltered conditions and is increasingly colonised by limpets, barnacles and mussels as wave exposure increases.

Recommended MCZ 10 is an important area for sea birds in the Irish Sea providing a foraging ground for a wide range of species including: guillemots *Uria aalge*, gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus*, razorbills *Alca torda* and puffins *Fratercula arctica*. Several of these birds are coastal species; they do not forage great distances, and originate from English and Scottish colonies (RSPB, pers comm., 2011). The large numbers of sand eels (*Ammodytes* spp) present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
High Energy Intertidal Rock	0.0045	-	Favourable condition	Maintain at favourable condition
Intertidal Biogenic Reefs	4.47	-	Favourable condition	Maintain at favourable condition

Subtidal Coarse Sediment	22.05	-	Favourable condition	Maintain at favourable condition
Subtidal Sand	11.26	-	Favourable condition	Maintain at favourable condition
Habitats of Conservation Importance				
Honeycomb Worm Reef	1.01	32	Favourable condition	Maintain at favourable condition
Subtidal Sands and Gravels	35.00	172	Favourable condition	Maintain at favourable condition
Blue Mussel Beds	-	3	Favourable condition	Maintain at favourable condition
Peat and Clay Exposures	-	1	Favourable condition	Maintain at favourable condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 10, Allonby Bay**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed. However, restrictions could also be placed upon anchoring in areas of vulnerable MCZ features in the site including honeycomb worms *Sabellaria alveolata*.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
A Bronze Age spearhead was found in the site and, possibly, 3 Roman towers and a Roman milefort are located in the site. World War II military aircraft wrecks are also recorded in the site. There are records of peat in the site (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the future as it is relevant to its National Heritage Protection Plan (theme 3A1.2)	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated. If archaeologists respond to restrictions on anchoring over areas of Honeycomb Worm Reef by undertaking an alternative archaeological excavations in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the Impact Assessment (IA). If archaeological excavations do not take place as a result of this restriction, this will prevent interpretation of archaeological evidence from the site which will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 2b. Ports, harbours, shipping and disposal sites — **rMCZ 10, Allonby Bay**

Source of costs of the rMCZ

Management scenario 1: Not applicable to this site.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	Costs of impact of rMCZ on the sector
Disposal sites: There is one disposal site (Maryport Harbour Dispersive) within 5km of the rMCZ which is associated with the port of Maryport. The average number of licence applications received for this disposal site is 0.2 per year (based on the number of applications received for this disposal site between 2001 and 2010 (Cefas, pers. comm., 2011). ***Port Development:*** There is one port within 5km of this rMCZ: Maryport. No port developments are known to be planned within the 20 year period of the Impact Assessment (IA).	*£m/yr* / Scenario 1 / Scenario 2 Cost to the operator / 0.000 / 0.002* * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. ***Scenario 1*:** Not applicable. ***Scenario 2:*** Future licence applications for disposal of material in the disposal site and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 10, Allonby Bay**
Aquaculture, commercial fisheries, flood and coastal erosion risk management (coastal defence), recreation and water pollution from activities on land. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 10, Allonby Bay**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Relatively little fishing takes place in the site. Fewer than five vessels are known to beam trawl in parts of the site for prawns, pollack and brown shrimps. The area may have previously been dredged for mussels. Fewer than five vessels use gill nets to target skate, plaice, bass and salmon; and fewer than five pot for lobsters. These fishing grounds will stretch up and down the Cumbrian coast. See Table 2 for more detail. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Biogenic reefs provide habitat for species that can be exploited for commercial fishing, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)). Dense growths of bushy hydroids and bryozoans could conceivably provide an important settling area for the spat of bivalves such as the scallops *Pecten maximus* and *Aequipecten opercularis*, adults of which are often abundant in nearby areas (OSPAR (2008) in Fletcher and others (2012)). In a Belgian intertidal nursery area, the density distribution of the flatfish species plaice *Pleuronectes platessa* was significantly explained by the presence of reefs built by the polychaete *Lanica conchilega* (Rabaut (2010) in Fletcher and others (2012)). Intertidal rock habitats are important sources of larval plankton upon which commercially important fish species feed, including mussels and larval fish of plaice and mackerel (Fletcher and others (2012)). Honeycomb worm *S. alveolata* reefs in the UK also provide attachment for seaweed communities (Hill (1998) in Fletcher and others (2012)). They can stabilise mobile sediment, enabling sea bed species to establish communities (Holt and others (1998); Jones, Hiscock & Connor (2000); both in Fletcher and others	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No additional management (above that in the baseline situation) of fishing activities is expected. As such, no benefits are expected to accrue as a result of reduced fishing mortality. No change in on-site feature condition or fishing mortality is anticipated and therefore no impact on on-site or off-site benefits is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⟺ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 10, Allonby Bay**
(2012)) and can bind unstable rocky ground restricting drainage, which creates rock pool refuges for prawns, blennies and hermit crabs (Lancaster (2008) in ISCZ 2011). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.		

Table 4b. Regulating services		**rMCZ 10, Allonby Bay**
Baseline	**Beneficial impact**	
Maintain: ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). Nitrate is removed from coastal waters by microbial biofilm on intertidal rock (Magalhaes (2003) in Fletcher and others (2012)). Intertidal biogenic reefs also filter large volumes of water (Dubois (2006); Forster (1995); Rabaut (2010) in Fletcher and others (2012)). The filter feeding of biogenic reefs is such that they affect energy flow over a much wider area than the reef itself (Holt and others (1998) in Fletcher and others (2012)). They play a key role in organic matter processing and nutrient cycling (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Maryport Roads, an area of subtidal coarse sediment that partly falls within this site, was surveyed extensively between the late 1960s and 1980s and has been noted as an area of high biodiversity (e.g. Perkins (1973; 1988) in ISCZ, 2011).	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in feature condition and management of human activities is expected and therefore no benefit to the regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⇔ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 10, Allonby Bay**
Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). Intertidal rock is generally of high biodiversity (Hill (1998) in Fletcher and others (2012)). On exposed rock, mussels, limpets, barnacles, fucoids and red seaweed are found. Cracks, crevices and rock pools increase species richness and abundance (Baker (1987) in Fletcher and others (2012)). During the summer, ephemeral green and red seaweeds dominate intertidal rock (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). In general, honeycomb worm reefs increase the habitat complexity of the surrounding environment and provide microhabitats for other organisms in crevices and cavities (Hill (2010) in Fletcher and others (2012)). Blue mussel beds in areas of soft sediment provide an area of hard substrata (Hill and others (2010) and references therein) and create biogenic structurally complex habitats that provide refuge for a range of flora and fauna not observed on surrounding sediments (Hill (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition. ***Natural hazard protection:*** Intertidal rock provides a natural form of protection from erosion by reducing the wave energy that reaches the shore (Anthony (2008) in Fletcher and others (2012)). Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (Riding (2002); McManus (2001); in Fletcher and others (2012)).		

Table 4c. Recreation		**rMCZ 10, Allonby Bay**
Baseline	**Beneficial impact**	
Allonby beach is popular with walkers, bird watchers and kite surfers. Shore angling also takes place from the rocks. Recreational vessels will sometimes pass through the site although the waters are shallow here and largely intertidal. Fletcher and others (2011) identify that the features to be protected by the rMCZ can contribute to the delivery of recreation and tourism services. In particular, blue	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in on-site feature condition or fishing mortality is anticipated and therefore no impact on on-site or off-site benefits is expected (see Table 4a 'Fish and shellfish for human consumption' for further	Anticipated direction of change: ⇔

mussel beds are noted as an important food source for birds such as knots, turnstones, sandpipers, herring gulls, crows and scoters (Nehls and Thiel (1993, cited in Tyler-Walters, 2008) in ISCZ, 2011) which will benefit bird watchers. It is likely that mussel beds will provide biological processes that also support various fish species which in turn will benefit anglers. Rock pools are particularly important habitats of intertidal rock that attract visitors to the marine environment. The baseline quantity and quality of the ecosystem service provided is assumed to be commensurate with that provided by the features of the site when in a favourable condition.	details). Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits). The designation may lead to an increase, in time, of anglers and bird watchers to the site, which may benefit the local economy. This increase may represent a redistribution of location preferences rather than an overall increase in angling and bird watching.	Confidence: Moderate

Table 4d. Research and education	**rMCZ 10, Allonby Bay**	
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Intertidal rocky shores are a classic focus for research and there is a wealth of historical data regarding many aspects of ecology (Connell (1961) in Fletcher and others (2012)). Such baseline data are extremely useful for exploring the impacts of environmental change (Hawkins (2009) in Fletcher and others (2012)). Rocky intertidal zones have been an active area of research because communities are well defined and accessible, and so can be easily and efficiently surveyed (Hill (1998) in Fletcher and others (2012)). Peat and clay exposures are an important archaeological resource which may potentially provide historical and environmental data about human activity.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4e. Non-use and option values	**rMCZ 10, Allonby Bay**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4e. Non-use and option values		**rMCZ 10, Allonby Bay**
	the risk of future degradation. A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of six members of the public who commented on the potential designation of rMCZ 10, four said it was a 'good' or 'very good' idea. Reasons stated included the need to protect the area from industrial development. Two respondents said it is a good thing although they had concerns about the rMCZ affecting recreational use.	

Recommended Marine Conservation Zone (rMCZ) 11, Cumbrian Coast — Site area (km^2): 17.17

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts	**rMCZ 11, Cumbrian Coast**

1a. Ecological description

Recommended MCZ 11 is located on the Cumbrian coast in the eastern Irish Sea, extending from St Bees Head in the north to the Ravenglass Estuary in the south. The site is almost wholly intertidal, and is recommended to protect features such as biogenic reefs, blue mussel *Mytilus edulis* beds and honeycomb worm *Sabellaria alveolata* reefs (Lancaster (2010) in ISCZ, 2011). There are also peat and clay exposures (Seeley and others (2010) in ISCZ, 2011) and intertidal underboulder communities (Lancaster (2010) in ISCZ, 2011) present in the site.

The northern portion of the site extends further seawards than the low water mark to incorporate an important black guillemot feeding and loafing area. This will complement the Royal Society for the Preservation of Birds (RSPB) reserve/Site of Special Scientific Interest (SSSI) protection on the cliffs of St Bees Head. St Bees Head is the only known location for breeding black guillemot in England. Recommended MCZ 11 is an important area for sea birds in the Irish Sea, providing a foraging and loafing ground for a wide range of species including guillemots *Uria aalge*, razorbills *Alca torda* and puffins *Fratercula arctica* which originate from English and Scottish colonies (RSPB, pers comm., 2011).

This site includes some of the most extensive and best represented examples of honeycomb worm *Sabellaria alveolata* reefs in the UK. Individually, these tube-dwelling worms cement together sand grains to form the structure in which they live. Collectively, these structures are important to sediment dynamics and they also support a range of other species.

In addition, the blue mussel beds fulfil a similar biogenic reef function by providing shelter for other species, such as the periwinkles, dog whelks and algae recorded in rMCZ 11 (Lancaster (2010) in ISCZ, 2011). The intertidal underboulder communities in this area are also notably diverse. Beadlet anemones *Actinia equina*, purse sponges *Sycon ciliatum*, hornwrack *Flustra foliciacea*, starfish *Asterias rubens*, long and broad clawed crabs *Pisidia longicornis* and *Porcellana platycheles*, keel worms *Pomatoceros lamarcki*, shore crabs and dahlia anemone *Urticina feline* were all recorded (Lancaster (2010) in ISCZ, 2011).

Peat and clay exposures are visible along parts of the southern portion of rMCZ 11 (Hazell (2008, used in Seeley and others, 2010) in ISCZ, 2011). A UK Biodiversity Action Plan (UK BAP) priority habitat, the key species associated with peat and clay exposures are piddocks, a type of burrowing bivalve, *Pholas dactylus*, *Barnea candida* and *Barnea parva*. The fact that these exposures are an irreplaceable habitat type (they are composed of former lake bed sediments and ancient forested peatland (termed 'submerged forests') underlies their ecological significance, but also their archaeological interest.

Recommended MCZ 11 also encompasses the full extent of Barn Scar and Kokoaprah Rocks. These two cobble and boulder scars are particularly diverse in marine life. Species such as: barnacles, common limpets, beadlet anemones, tube worms, encrusting sponges, bryozoans, sea squirts, periwinkles, topshells, whelks, sea urchins, some starfish, csommon shore crabs, shrimps and blennies can all be found. The lower shore exhibits seaweeds such as sugar kelp and oarweed and toothed wrack *Fucus seratus*, spiral wrack *Fucus spiralis* and bladder wrack *Fucus vesiculosus*. Under the canopy of seaweeds, rocks are covered with byrozoans and hydroids, barnacles and Ross worm *Sabellaria spinulosa* crusts (Lancaster (2010) & Lumb, pers. comm., 2011, in ISCZ, 2011). Mid-shore, Barn Scar to Drigg coast has some persistent scar areas with small honeycomb worm *Sabellaria alveolata* mounds and mussels *Mytilus edulis* (Lancaster (2010) in ISCZ, 2011).

The rocky shore habitat present around St Bees Head is one of the most exposed shores on the Cumbrian coast (Lancaster (2010) in ISCZ, 2011) and is a rare habitat type throughout the ISCZ project region. A range of algal species has been recorded there. Dulce (a red algae) and Irish moss can be found on the lower shore; in the mid-shore

zone red seaweeds, bladder wrack and fucus are present, while spiral and egg wrack are common on the upper shore (Lancaster (2010) in ISCZ, 2011). The red sandstone that makes up the rocky shore is an important area for algae, such as narrow leafed eelgrass *Zostera angustifolia* (Brodie and others (2007) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
High Energy Intertidal Rock	0.04	-	Favourable condition	Maintain at favourable condition
Intertidal Sand and Muddy Sand	5.01	-	Unfavourable condition	Recover to favourable condition
Intertidal Biogenic Reefs	0.85	-	Favourable condition	Maintain at favourable condition
High Energy Infralittoral Rock	0.40	-	Unfavourable condition	Recover to favourable condition
Habitats of Conservation Importance				
Blue Mussel Beds	-	2	Favourable condition	Maintain at favourable condition
Intertidal Underboulder Communities	-	8	Favourable condition	Maintain at favourable condition
Peat and Clay Exposures	-	2	Favourable condition	Maintain at favourable condition
Honeycomb Worm Reefs	0.61	11	Unfavourable condition	Recover to favourable condition
Non-ENG Features				
Black Guillemots	-	< 50 pairs	Favourable condition	Maintain at favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage **rMCZ 11, Cumbrian Coast**

Source of costs of the rMCZ

Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed. However, restrictions could also be placed upon anchoring in areas of vulnerable MCZ features in the site, including Honeycomb Worm Reef, and upon archaeological excavation in areas of peat and clay exposures in the site.

Baseline description of activity	Costs of impact of rMCZ on the sector
The wreck of a Spanish steamer vessel is recorded in the site. A further 64 vessel wrecks are attributed to this area as well as one British World War II aircraft. However, it is not clear if the wrecks are located in the site or nearby. Peat is recorded at St Bees and at Drigg. Mesolithic flint sites and hearths have also	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one

been recorded in the site. A historic fish trap is also located in the site (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the future as it is relevant to its National Heritage Protection Plan (theme 3A1.2).	licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated. If archaeologists respond to restrictions on excavation in areas of peat and clay exposures, and restrictions on anchoring over areas of Honeycomb Worm Reef, by undertaking an alternative archaeological excavations in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the Impact Assessment (IA). If archaeological excavations do not take place as a result of these restrictions, this will prevent interpretation of archaeological evidence from the site which will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 2b. Coastal development	**rMCZ 11, Cumbrian Coast**
Source of costs of the rMCZ ***Management scenario 1:*** Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The need for a new marine landing facility at the new nuclear power station at Sellafield (planned for delivery before 2025) was identified in the 2011 National Nuclear Policy Statement. Submission of a licence application is not anticipated for at least 5 years (Natural England, pers. comm., 2012). As such, no further information is available at this time. However, the impact of any development on the features of conservation importance (not broad-scale habitats) protected by the rMCZ, would have to be assessed already in the absence of the rMCZ. A temporary landing facility was recently given planning permission at Sellafield and this did not have significant environmental impacts upon features of conservation importance in the rMCZ (this occurred regardless of the rMCZ) (Natural England, pers. comm., 2012). The operator of Sellafield nuclear power station carries out environmental monitoring of the coastline at various	The MCZ is unlikely to prohibit the installation of a marine landing facility in the site (although this does not pre-judge a licensing decision) (Natural England, pers. comm,. 2012). Planning permission was given recently to a temporary landing facility at the same location which considered its impact upon features of conservation importance. Impact upon the rMCZ features in the vicinity of the proposed facility is therefore considered in the absence of the MCZ designation. It is likely that an additional cost will be incurred in the assessment of environmental impact in support of the licence application, and that some re-routing of vehicle access during construction or operation may be required to avoid the sensitive features. Based on the information available, it is not possible to identify what other additional mitigation due to the rMCZ may be required, and therefore it is not possible to quantify the likely cost. However, based on the experience with the temporary landing facility, Natural England feels that this is unlikely to affect construction significantly and incur a significant cost (Natural England, pers. comm., 2011). Natural England (pers. comm., 2012) has advised that it is unlikely that the monitoring programme would be considered to have an impact on the features of the site. This is because the sample/monitoring area is very small in relation to the area of broad-scale habitat. With regards to features of conservation importance in the rMCZ, due regard to the potential impact of the monitoring programme upon these feature would need to be considered in the absence of the MCZ designation. Therefore, it is not anticipated that additional costs would be

Table 2b. Coastal development	**rMCZ 11, Cumbrian Coast**
Source of costs of the rMCZ ***Management scenario 1:*** Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
sampling points in this rMCZ. Monitoring is undertaken to assess the impacts that discharges from Sellafield nuclear power station have on people and the environment. This takes place along the coastline and in the sea. It is possible that monitoring frequency and scale could increase during the course of the IA period of analysis (Environment Agency, pers. comm., 2012).	incurred to the operator of Sellafield due to the presence of the MCZ.

Table 2c. Commercial fisheries — **rMCZ 11, Cumbrian Coast**

Source of costs of the rMCZ

The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling and the use of hooks and lines will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the IA for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range.

Management scenario 1: Entire rMCZ is open to all gear types.

Management scenario 2:*

- Closure of areas of High Energy Infralittoral Rock to pots and traps only.
- Closure of areas of biogenic reefs, Honeycomb Worm Reefs, peat and clay exposures and mussel beds to hand collection of shellfish.
- Gill netting and vessel speed managed out to 1km offshore from St Bees' Head only. The required management has not yet been identified and is subject to further stakeholder discussion. For the purpose of the IA, it is assumed that no management of gill netting and vessel speed will be required.

Management scenario 3:* Closure of entire rMCZ to bottom trawls, dredges, hooks and lines, nets (including gill netting), pots and traps, and collection by hand.

* This is the management scenario identified by the vulnerability assessment using information collected from stakeholders.

** Natural England and the JNCC advise that hooks and lines, nets, and pots and traps need to be managed in the vicinity of High Energy Infralittoral Rock only; and that collection by hand needs to be managed only in the vicinity of Intertidal Sand and Muddy Sand only. However, for ease of analysis, the loss of landings estimate represents the loss of landings from the entire rMCZ and as such will be an overestimate.

Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) limit. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2007–10), at least 15 UK vessels are known to fish in this site (both under and over 15 metre vessels). They use bottom trawls, pots and traps, mid-water trawls, nets, dredges, and hooks and lines. These vessels are all from Cumbrian and Lancashire ports (ISCZ, 2010). However, as the site is immediately adjacent to the shore (and 500 metres wide in most places), it is thought that not all of these vessels would actually be fishing this close to shore. Vessel Monitoring System (VMS) data for over 15 metre vessels do not provide any

Table 2c. Commercial fisheries **rMCZ 11, Cumbrian Coast**

evidence of fishing activity this close to shore (MMO, 2011a). Fewer than 5 fishers are known to regularly use hand gear and hand-pick in and around the site for mussel, cockle, razor clam and shrimp (ISCZ, 2010); however, the level of effort depends on the occurrence of mussel and cockle beds and when they are opened to harvesting. When mussel and cockle beds are opened, the numbers of fishers hand-picking in the site will greatly increase. The estimated total value of landings (including hand collection of shellfish) from the site is £0.094m/yr, but in years when shellfish spats occur and the beds are opened for commercial gathering the value can increase to £5m to £10m/yr (based on an internet search for media reports covering the last ten years). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: At least nine vessels are known to use bottom trawls in the site (ISCZ, 2010). These vessels are associated with the ports of Whitehaven, Workington, Maryport, Fleetwood and Barrow. They target a mix of species throughout the year: brill, cod, common prawn, dover sole, plaice, pollack, rockfish, skates and ray, solenette, turbot and whitefish (ISCZ, 2010). The estimated value of landings from the site is £0.070m/yr.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.000 | 0.070 Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with bottom trawls at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.
Dredges: Fewer than 5 vessels are known to use dredges in the site (ISCZ, 2010). They are all from English ports, targeting mussel seed when spats arise and permission is granted (ISCZ, 2010). The estimated value of landings from the site is £0.002m/yr. This value is likely to be highly variable, and much higher in years when mussel spat occurs within the rMCZ.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.000 | 0.002 Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with dredges at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.
Pots and traps: Fewer than 5 UK vessels are known to use pots and traps in the vicinity of High Energy Infralittoral Rock in the site for lobster and crab. At least nine vessels using pots and traps are known to be active in the entire site (ISCZ, 2010). They are active all year but mostly in the summer months. VMS data does not indicate any fishing activity by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £0.010m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.001 | 0.010 Stakeholders have not provided a description of impact. Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.
Collection by hand (mussel only): About three fishers commercially gather winkle ('covins') at Barn Scar, which accommodates blue mussel	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3

Table 2c. Commercial fisheries **rMCZ 11, Cumbrian Coast**

beds and Honeycomb Worm Reefs. However, there has been very little activity there in recent years. The level of winkle gathering is dependent on demand from the European market. There are sudden increases in activity when the prices are good. This has been known to attract gangs and migrant workers. The winkles are bought and sold through local agents. There is also non-commercial crab hooking at Barn Scar (Whitehaven Fishermen's Association & NWIFCA, 2011).

Fewer than five fishers are known to collect mussel by hand in the site. It is assumed that this takes place in the parts of the site which are vulnerable to this activity (as listed above) (ISCZ, 2010). It should be noted that commercial gathering of mussels is managed by the North Western Inshore Fisheries and Conservation Authority (NWIFCA) along the Cumbrian coast. NWIFCA knows of no commercial mussel picking in this particular site. However, winkle gathering and crab hooking is likely to take place in the site and could take place in the vicinity of sensitive MCZ features (Whitehaven Fishermen's Association & NWIFCA, 2011).

The estimated value of landings from the site is 0.012m/yr (MCZ Fisheries Value Model).

The FisherMap data are the best available data for intertidal fisheries. However, confidence in the data is low as, on the one hand, they are overestimates because the fishing grounds mapped by fishers represent areas greater in size than the rMCZ itself and will include values for nearby valuable cockle and mussel fishery areas such as the Ribble Estuary and Morecambe Bay. On the other hand, not every intertidal fisher has been interviewed, although we estimate about 30% of regular north-west of England intertidal fishers provided data.

It should be noted that the estimated values are only indicative due to the inherent un-predictability of where and when cockle and mussel spats will occur, and whether they will be opened for harvesting. Also, because the numbers of people attracted who harvest from cockle and mussel beds when they are opened are unpredictable and difficult to manage, the real economic value of these beds is very hard to estimate. In the north-west of England waters, trends indicate that usually one large bed is opened once every 4 or 5 years, each generating in the region of £5m to £10m/yr worth of shellfish (based on an internet search for media reports covering the last ten years).

Value of landings affected	0.000	0.001	0.001

In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to collection by hand at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.

Comments from the Cumbrian fishing fleet and NWIFCA: *Regarding Scenarios 2 and 3:* Collection by hand will be managed in areas of Intertidal Sand and Muddy Sand only. It is not clear if this activity takes place on Intertidal Sand and Muddy Sand; therefore, the estimate of impact may be over-stated. Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant. Further detail on impacts to the fisheries sector can be found in Annex J and Annex F.

<table>
<tr><th colspan="2">Table 2c. Commercial fisheries</th><th>rMCZ 11, Cumbrian Coast</th></tr>
<tr><td colspan="2">Hooks and lines: Fewer than 5 vessels are known to use hooks and lines in the site (ISCZ, 2010). They are associated with the port of Maryport. They target bass, cod and plaice (ISCZ, 2010).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant. Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with hooks and lines at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><td colspan="2">Nets: Fewer than 5 vessels are known to use nets in the site (ISCZ, 2010). They are all English vessels associated with the ports of Maryport and Whitehaven. They target bass, brill, cod, mullet, plaice, salmon, sole and turbot throughout the year (ISCZ, 2010).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant. Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with nets at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><th colspan="3">Total direct impact on UK commercial fisheries</th></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.002</td><td>0.083</td></tr><tr><td>GVA affected</td><td>0.000</td><td>0.001</td><td>0.034</td></tr></table>At least 16 vessels (using bottom trawls, pots and traps, nets, hooks and lines and dredges) could be affected and at least 5 intertidal fishers.
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: 4
Scenario 3: 16</td></tr>
</table>

Table 2c. Commercial fisheries	**rMCZ 11, Cumbrian Coast**
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
There is no evidence of non-UK vessels working in this site (MMO, 2011a).	None.

Table 2d. Flood and coastal erosion risk management (coastal defence)	**rMCZ 11, Cumbrian Coast**
Source of costs of the rMCZ ***Management scenario 1:*** Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Shoreline Management Plan (SMP) policy units that overlap with this rMCZ, but that are not anticipated to be impacted upon by it, are: 4.1, 5.2, 5.4, 5.5, 5.6, 7.1 and 1.1. This is because they are one of the following: no active intervention; managed re-alignment to natural shoreline; or hold the line (by maintaining defences, but seek to withdraw maintenance as soon as practicable). It is assumed for the purposes of the IA that there is no risk of erosion to the railway line within the 20-year IA period of analysis under policy units 5.2, 5.4, 5.5 and 5.6 (Natural England, pers. comm., 2012). SMP policy units (0–20 yrs) that could be impacted are as follows: • 5.1: Hold the line (by maintaining the rock gabions at shore car park and maintaining/reconstructing the seawall fronting the B5344). • 5.3: Hold the line (maintain linear revetment and rock armour defences). • 5.7: Hold the line (with limited intervention, monitor erosion risk to railway, then maintain/upgrade railway defences as necessary). • 6.1: Hold the line (maintain defences to maintain the beach amenity, do not extend defences into SSSI to the south. Conduct further studies into long-term solutions for future flood and coastal erosion risk management of the beach amenity). (Natural England & Environment Agency, pers. comm., 2012)	It is anticipated that no additional mitigation of impacts will be required (Natural England & Environment Agency, pers. comm., 2012). As a result of the rMCZ, it is anticipated that additional costs will be incurred in assessing environmental impacts in support of future licence applications for Flood and Coastal Erosion Risk Management (FCERM) schemes. For each licence application these costs are expected to arise as a result of approximately 0.5–1 day of additional work, in most cases, although there may be cases where further additional consultant time is needed (Environment Agency, pers. comm., 2012). It has not been possible to obtain information on the likely number of licence applications that will be made over the 20 year period of the IA or estimates of the potential increase in costs.

Table 2e. National defence **rMCZ 11, Cumbrian Coast**

Source of costs of the rMCZ

Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.

Baseline description of activity	Costs of impact of rMCZ on the sector
The Ministry of Defence is known to make use of part of the site for a military firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2f. Ports, harbours, shipping and disposal sites **rMCZ 11 Cumbrian Coast**

Source of costs of the rMCZ

Management scenario 1: Not applicable to this site.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	Costs of impact of rMCZ on the sector
Disposal sites: There are two disposal sites (Saltom Bay and Whitehaven) within 5km of the rMCZ. These are associated with the port of Whitehaven. The sum of the average number of licence applications received for these disposal sites is 0.1 per year (based on the number of licence applications received for these disposal sites between 2001 and 2010 (Cefas, pers. comm., 2011). ***Port development:*** The ports of Whitehaven, Sellafield and Ravenglass are located within 5km of this rMCZ. No port developments are known to be planned within the 20-year period of the IA.	<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.000</td><td>0.001</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. ***Scenario 1:*** Not applicable. ***Scenario 2:*** Future licence applications for disposal of material in the disposal sites and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2g. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 11, Cumbrian Coast**
Cables (interconnectors and telecom cables) Future interconnectors and telecom cables may pass through the rMCZ. Impacts of rMCZs on future interconnectors and telecom cables are assessed in the Evidence Base, Annex H6 and Annex N3 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 11, Cumbrian Coast**
Existing cables (telecom cables), recreation, shipping and water pollution from activities on land. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 11, Cumbrian Coast**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Fishing vessels using bottom trawls, pots and traps, mid-water trawls, nets, dredges, and hooks and lines are known to fish in the area; however, it is unlikely that all work in the intertidal area (the extent of this rMCZ). Intertidal fishers also collect mussels, clams and periwinkles by hand. See Table 2 for more detail. **Recover:** The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. Intertidal sand, muddy sand and mixed sediments are important spawning and nursery grounds (Fortes (2002) in Fletcher and others (2012)) for species including plaice	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to bottom trawls, dredges; and to hooks and lines, nets and pots, and traps and collection by hand in parts of the rMCZ. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ 11, Cumbrian Coast**
(Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Sole *Solea solea* and gadoids often visit sandy and mixed sediment (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Sandflats are frequented by sea bass and flounder as feeding grounds to predate on polychaetes and crustaceans, while migratory species such as salmon and shad pass through sandflat areas en route to other wetland habitats (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Infralittoral rock is a suitable habitat for inshore commercial fisheries species, particularly lobster and crab (Fletcher and others (2012)). Honeycomb worm reefs in the UK also provide attachment for seaweed communities (Hill (1998) in Fletcher and others (2012)). They stabilise mobile sediment, enabling sea bed species to establish communities (Holt and others (1998); Jones, Hiscock & Connor (2000); both in Fletcher and others (2012)). and can bind unstable rocky ground, restricting drainage, which creates rock pool refuges for prawns, blennies and hermit crabs (Lancaster, 2008; in ISCZ (2011)). Juvenile bivalves are known to settle on polychaete tubes as they provide attachment surfaces (Bolam, 2003). The density of flatfish species such as plaice *Pleuronectes platessa* has been linked to the presence of reefs built by the polychaete *Lanica conchilega* (Rabaut (2010) in Fletcher and others (2012)). **Maintain:** The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition. Intertidal rock habitats are important sources of larval plankton upon which commercially important fish species feed, including mussels and larval fish of plaice and mackerel (Fletcher and others (2012)). Underboulder areas may be important refuge areas for young crabs and juvenile lobsters at low tide. Boulders are also turned for the collection of periwinkles for human consumption (UK Biodiversity Partnership (2010) in Fletcher and others (2012)).	Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The prohibition of bottom trawling and dredging from some parts of the site could potentially open up opportunities for static gear fisheries (where this is allowed to continue in the site) (see Annex L). There may be benefits for mid-water trawlers which will be allowed to continue fishing in the site but there is currently no evidence to support or refute this. It is not known whether pelagic species would benefit from the proposed fisheries restrictions. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	

Table 4b. Regulating services		**rMCZ 11, Cumbrian Coast**
Baseline	**Beneficial impact**	
Recover: ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Intertidal biogenic reefs also filter large volumes of water (Dubois (2006); Forster (1995); Rabaut (2010) in Fletcher and others (2012)). The filter feeding of biogenic reefs is such that they affect energy flow over a much wider area than the reef itself (Holt and others (1998) in Fletcher and others (2012)). They play a key role in organic matter processing and nutrient cycling (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). Fundamental ecosystem processes including nutrient cycling are evident in intertidal sand and muddy sand (Fletcher and others (2012)). Active sulphur cycling was found to be more dynamic in sandy sediments than in muddy sediments (minutes rather than hours). Sulphate reduction has been reported as the most important process leading to a reflux of carbon dioxide into the water column (Al-Raei (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Infralittoral rock is extremely rich in faunal and floral species due to the range of habitats provided by kelp communities within the subtidal zone (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Muddy sand supports communities of polychaetes and bivalves, including the lugworm, cockles and may also have eelgrass (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). In general, honey comb worm reefs increase the habitat complexity of the surrounding environment and provide microhabitats for other organisms in crevices and cavities (Hill (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Muddy shores (intertidal sand and muddy sand) are important for coastal protection, acting as buffers against incoming wave energy (Fortes (2002) in Fletcher and others (2012)). Soft-sediment intertidal habitats create	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to bottom trawls, dredges; and to hooks and lines, nets and pots, and traps and collection by hand in parts of the rMCZ. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 11, Cumbrian Coast**
greater resistance to erosion (Underwood (2003) in Fletcher and others (2012)). **Maintain:** ***Regulation of pollution:*** The features of the site contribute to the recycling of waste and capture of carbon. Nitrate is removed from coastal waters by microbial biofilm on intertidal rock (Magalhaes (2003) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. The underboulder habitat, along with fissures, crevices and any spaces between adjacent boulders, forms a series of microhabitats that add greatly to the biodiversity of a shore (Hill (2010) in Fletcher and others (2012)). Intertidal rock is generally of high biodiversity (Hill (1998) in Fletcher and others (2012)). On exposed rock, mussels, limpets, barnacles, fucoids and red seaweed are found. Cracks, crevices and rock pools increase species richness and abundance (Baker (1987) in Fletcher and others (2012)). During the summer, ephemeral green and red seaweeds dominate intertidal rock (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Blue mussel beds in areas of soft sediment provide an area of hard substrata (Hill and others (2010) and references therein) and create biogenic structurally complex habitats that provide refuge for a range of flora and fauna not observed on surrounding sediments (Hill, 2010). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition. ***Natural hazard protection:*** Intertidal rocks and boulders provide a natural form of protection from erosion by reducing the wave energy that reaches the shore (Anthony, 2008; UK Biodiversity Partnership (2010); both in Fletcher and others (2012)). Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (McManus (2001), Riding (2002); both in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No change in feature condition and management of human activities is expected and therefore no benefit to the regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change:  Confidence: Moderate

Table 4c. Recreation	**rMCZ 11, Cumbrian Coast**	
Baseline	**Beneficial impact**	
Numerous recreational activities take place up and down the Cumbrian coast within this rMCZ (angling, sailing, swimming, walking, bird watching, kite surfing etc.). Of particular relevance is St Bees Head. The Coast to Coast long-distance path begins/ends here and attracts in the region of 10,000 to12,000 people annually. The RSPB (pers. comm., 2012) estimates that an additional 1,000 people visit St Bees Head each year because of its status as a nature reserve and to view the breeding sea bird colony on the cliffs. A charter boat offering wildlife-watching trips also visits the vicinity of St Bees Head . Fletcher and others (2012) identify that the features to be protected by the rMCZ can contribute to the delivery of recreation and tourism services. In particular, blue mussel beds are noted as an important food source for birds such as knots, turnstones, sandpipers, herring gulls, crows and scoters (Nehls and Thiel (1993, cited in Tyler- Walters, 2008) in ISCZ 2011) which will benefit bird watchers. Intertidal mud and sandflats are important areas for shore birds and some wildfowl during the low water period and for diving ducks and fish during the high water period (Evans (1998) in Fletcher and others (2012)). Shore birds migrating from breeding to wintering grounds are important predators on sandflats in north-west Europe (UK sites include the Wash, Morecombe Bay, Poole Harbour and the Solent) (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The MCZ features will also provide biological processes that support various fish species which in turn will benefit anglers. Intertidal underboulder communities provide bait for anglers (Sewell (2005) in Fletcher and others (2012)). Rock pools are particularly important habitats of intertidal rock that attract visitors to the marine environment. The baseline quantity and quality of the ecosystem service provided is assumed to be commensurate with that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Due to the ecological services of features to be recovered in the site (honeycomb worm reefs, intertidal sand and muddy sand), MCZ designation may lead to an increase, in time, of anglers and bird watchers to the site, which may benefit the local economy. Various studies demonstrate the local economic value of sea angling (Scottish Government, 2009; Invest in Fish South West, 2005); however, it has not been possible to quantify the potential impact for this rMCZ. Sea birds are known to attract visitors, which in turn generates local economic value. A study of four RSPB marine reserves has highlighted the fact that, on average, an estimated additional income of £300,000 a year can be generated and directly attributed to sea bird watching within a designated nature reserve (RSPB, 2010). On average, this has supported up to the equivalent of nine full-time jobs at each reserve. While this is the estimated local economic value generated in the absence of MCZs, it emphasises that MCZs could provide ecological benefits for sea birds which in turn could generate local economic value if sea bird numbers increase or are given more protection. However, it is not clear from the research if economic value is likely to increase with sea bird numbers or additional protection. It is, however, likely that a better quality of experience (i.e. more sea birds) would attract more visitors. Regardless, such impacts are likely to be local and represent a redistribution of sea bird watching rather than an overall increase in bird watchers nationally. The ecological and recreational benefits potentially provided by this rMCZ would complement Copeland Borough Council's coastal park programme. This aims to improve visitor facilities and experience of the marine environment while increasing visitor numbers, jobs and economic opportunity along the west Cumbrian coast. This will extend from Whitehaven to Millom.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4d. Research and education		**rMCZ 11, Cumbrian Coast**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. The intertidal areas, including the rocky shores and biogenic reefs, have been extensively studied by Lancaster (2010, in ISCZ, 2011) on behalf of NWIFCA for many years. Intertidal rocky shores are a classic focus for research, and there is a wealth of historical data regarding many aspects of ecology (Connell (1961) & Paine (1969) in Fletcher and others (2012)). Such baseline data are extremely useful for exploring the impacts of environmental change (Hawkins (2009) in Fletcher and others (2012)). Rocky intertidal zones have been an active area of research because communities are well defined and accessible, and so can be easily and efficiently surveyed (Hill (1998) in Fletcher and others (2012)). Peat and clay exposures are an important archaeological resource which may potentially provide historical and environmental data about human activity. It is known that intertidal underboulder communities are used for education, research and nature watching. These activities take place in coastal areas with relatively easy access to the shore and generally involve overturning boulders to view the flora/fauna which live underneath. Many organisations, such as the Wildlife Trusts and the Marine Life Information Network (MarLIN), co-ordinate such activities for educational and research purposes for schools, community groups and tourists.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4e. Non-use and option values		**rMCZ 11, Cumbrian Coast**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice'	Anticipated direction of change: ⇧ Confidence: Moderate

	campaign (Ranger and others, 2011), ten 'nominated sites' fall within the boundary of rMCZ 11. The nominations are mostly adjacent to St Bees Head, and were made by recreational users and professionals in the environment sector. The main reason given for protection of this site was the personal attachment these people feel towards this section of the UK coastline. One recreational sea user mentioned the importance of the area as a breeding ground for sea birds, citing this as a reason for protection. Professionals working in the environment sector recommended that the nominated sites protect the *Sabellaria* reef in the area. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H). A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of 19 members of the public who commented on the potential designation of rMCZ 11, 18 of them said it was a 'good' or 'very good' idea. Reasons stated included the need to conserve and protect marine biodiversity for future generations as long as this does not affect recreational use of the site.	

Recommended Marine Conservation Zone (rMCZ) 13, Sefton Coast — Site area (km^2): 13.19

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 13, Sefton Coast**

1a. Ecological description

This site is situated on the (Merseyside) Sefton coast between Formby Point and Crosby beach. It is in the intertidal zone, extending from the mean high water mark to the mean low water mark, and overlaps with the Sefton Coast Special Area of Conservation (SAC). The site was proposed for protection of peat and clay exposures. This habitat feature is of archaeological interest, as the exposures are composed of former lake bed sediments and ancient forested peatland. The exposures adjacent to Formby Point contain preserved animal and human footprints which date back to the Stone Age (Roberts and others (1996) in ISCZ, 2011).

Benthic habitats formed from exposed peat or clay, or in some cases both, are uncommon and provide important habitats for a variety of species such as burrowing bivalves, including piddocks, *Pholas dactylus*, *Barnea candida* and *Barnea parva*, seaweeds and crabs (NBN Gateway (2011) in ISCZ, 2011). Depending on the level of sand scour present, the surface of peat exposures can be covered with algal mats made of red and green seaweeds *Ceramium* sp. and *Ulva lactuca* and *Ulva intestinalis*. Hydroids can be present within small pools of water and crabs shelter within crevices, e.g. shore crabs *Carcinus maenas* and edible crabs *Cancer pagurus* (Maddock (2010) in ISCZ, 2011). On the surface of clay exposures, there tends to be less seaweed coverage; instead, small clumps of blue mussels *Mytilus edulis* can be present, alongside barnacles and periwinkles *Littorina littorea*, while polychaete worms live within the clay, e.g. *Polydora* sp. and *Hediste diversicolor* (Maddock (2010) in ISCZ, 2011). Both peat and clay exposures are soft enough to be burrowed into by piddocks *Pholas dactylus*, and the holes created by these burrowing bivalves provides an important microhabitat for species such as crabs and anemones, e.g. the daisy anemone *Cereus pedunculatus* and the gem anemone *Aulactinia verrucosa* (Maddock (2010) in ISCZ, 2011). In clay-rich areas, common mussels, periwinkles and polychaete worms have also been noted. Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Habitats of Conservation Importance				
Peat and Clay Exposures	-	2	Unfavourable condition	Recover to favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage — **rMCZ 13, Sefton Coast**

Source of costs of the rMCZ

Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and

visitors will be allowed. However, restrictions could also be placed upon archaeological excavation in areas of peat and clay exposures in the site.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
There is evidence of over 100 wrecks in the site. A number of Mesolithic and prehistoric features have also been recorded, including human, animal and bird footprints and finds of horse, boar and stag bones. Peat deposits are also recorded within the site (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the future as it is relevant to its National Heritage Protection Plan (theme 3A1.2)	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated. If archaeologists respond to restrictions on excavation in areas of peat and clay exposures by undertaking an alternative archaeological excavation in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the Impact Assessment (IA). If archaeological excavations do not take place as a result of this restriction, this will prevent interpretation of archaeological evidence from the site which will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 2b. Commercial fisheries **rMCZ 13, Sefton Coast**

Source of costs of the rMCZ

The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, hooks and lines, nets, and pots and traps will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the IA for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range.

Management scenario 1: Entire rMCZ is open to all gear types.

Management scenario 2:*** Closure of the rMCZ to bottom trawls around peat and clay exposures only.

Management scenario 3:***** Closure of the entire rMCZ to bottom trawls, hooks and lines, nets, pots and traps, and collection by hand.

* This is the management scenario identified by the vulnerability assessment using information collected from stakeholders.

** Natural England and the JNCC advise that bottom trawls, hooks and lines, nets, pots and traps, and collection by hand need to be managed in the vicinity of peat and clay exposures only but for ease of analysis; as the locations of peat and clay exposures are not fully known at this time, the loss of landings estimate represents the loss of landings from the entire rMCZ.

Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2007–10), at least 11 UK vessels are known to fish in this site (under 15 metre vessels only). These vessels use beam trawls, bottom trawls, long lines, different types of nets (gill and fixed), and pots and traps (ISCZ, 2010). Also at least four intertidal fishers use shank nets and push nets in the site to target shrimp, cod and bass. Other intertidal fishers hand-pick for cockles as and when the spat arises and the beds are opened (ISCZ, 2010). At least five fishers are known to regularly use hand gear and hand-pick in and around the site for mussel,

Table 2b. Commercial fisheries **rMCZ 13, Sefton Coast**

cockle, razor clam and shrimp (ISCZ, 2010); however, this depends on the occurrence of mussel and cockle spat and when the beds are opened to harvesting. At such times, the numbers of fishers hand-picking in the site can greatly increase. Vessel Monitoring System (VMS) data for over 15 metre vessels provide evidence of UK beam trawling quite close to the shore (MMO, 2011a). There is no evidence of dredging taking place in the site. The estimated total value of landings (including hand collection of shellfish) from the site is £0.097m/yr but in years when shellfish spats occur and the beds are opened for commercial gathering the value can increase to £5m to£10m/yr (based on an internet search for media reports covering the last ten years). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: At least five vessels are known to use bottom trawls and beam trawls in the site. They target shrimp, sole, plaice, flounder, solenette, dab and cod throughout the year. These vessels are associated with the home ports of New Brighton, Chester, Lytham St Annes and Thurstaston (ISCZ, 2010). VMS data indicates that beam trawls are used by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £0.004m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.000 | 0.004 Stakeholders have not provided a description of impact.
Hooks and lines: Fewer than five vessels are known to use lines in the site. They use long lines to target bass all year. These vessels are associated with the home port of New Brighton (ISCZ, 2010). VMS data does not indicate the use of hooks and lines by over 15 metre UK vessels in the site. The estimated value of landings from the site is <£0.001m/yr.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.000 | <0.001 Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with hooks and lines at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.
Nets: At least six vessels are known to use nets in the site. They target bass, cod, flounder, salmon, mackerel, mullet, plaice, shrimp and sole throughout the year. These vessels are associated with the home ports of New Brighton, Chester, Liverpool, Greenfield, Southport and Thurstaston (ISCZ, 2010). VMS data does not indicate the use of nets by over 15 metre UK vessels in the site. The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.000 | <0.001 Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with nets at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.
Pots and traps: Fewer than five vessels are known to use pots and traps in the site. They target lobster from March to December. These vessels	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th colspan="2">rMCZ 13, Sefton Coast</th></tr>
<tr><td colspan="2">are associated with the home ports of Liverpool and Greenfield (ISCZ, 2010). VMS data does not indicate the use of pots and traps by over 15 metre UK vessels in the site.
The estimated value of landings from the site is £0.002m/yr (MCZ Fisheries Value Model).</td><td colspan="2"><table><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td>0.002</td></tr></table>Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, peat and clay exposures may have been assessed as having low vulnerability to fishing with pots and traps at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><td colspan="2">Collection by hand: Five intertidal fishers are known to use hand gear to collect species such as cockle, mussel, razor clam and shrimp from rMCZ 13 (ISCZ, 2010). The collection of cockle and mussel is already managed by the North Western Inshore Fisheries and Conservation Authority (NWIFCA).
The estimated value of landings from the site is £0.088m/yr (ISCZ, 2010).
The FisherMap data for intertidal fisheries are the best available data. However, confidence in the data is low as, on the one hand, they are overestimates because the fishing grounds mapped by fishers represent areas greater in size than the rMCZ itself and will include values for nearby valuable cockle and mussel fishery areas. On the other hand, not every intertidal fisher has been interviewed, although we estimate about 30% of regular north-west of England intertidal fishers provided data.
It should be noted that values are only indicative due to the inherent un-predictability of where and when cockle and mussel spats will occur, and whether they will be opened for harvesting. Also, due to the because the numbers of people attracted to cockle and mussel beds when they are opened is so unpredictable and difficult to manage, the real economic value of these beds is very hard to estimate. In the north-west of England waters, trends indicate that usually one large bed is opened once every 4 or 5 years, each generating in the region of £5m to £10m/yr worth of shellfish (based on an internet search for media reports covering the last ten years).</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td>0.088</td></tr></table>Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to collection by hand at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><td colspan="4">Total direct impact on UK commercial fisheries</td></tr>
<tr><td colspan="2">At least 13 UK vessels and at least 5 regular intertidal fishers may be affected (ISCZ, 2010).</td><td colspan="2">The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td>0.094</td></tr></table></td></tr>
</table>

Table 2b. Commercial fisheries — **rMCZ 13, Sefton Coast**

GVA affected	0.000	0.000	0.043

Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: 5
Scenario 3: 13

Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
***Impact on non-UK commercial fisheries*:** VMS does not indicate any fishing activity by non-UK over 15 metre non-UK vessels in this site (MMO, 2011a).	None.

Table 2c. Ports, harbours, shipping and disposal sites — **rMCZ 13, Sefton Coast**

Source of costs of the rMCZ

Management scenario 1: Increase in costs of assessing environmental impacts for future licence applications within 1km of an rMCZ. This applies to future navigational dredging and disposal of dredge material only. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities relative to the mitigation provided in the baseline.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. Additional costs incurred in updating existing Maintenance Dredging Protocols (MDPs). It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Navigational dredge areas: There are four licensed navigational dredge areas within 1km (and within 5km) of the rMCZ. All are associated with the port of Liverpool. It is assumed that each dredge area's marine licence is renewed once every three years and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. As these navigational dredge areas are covered by an existing MDP, it is assumed that the assessment of environmental impact is not changed over the 20 year period of the IA.	

£m/yr	Scenario 1	Scenario 2
Cost to the operator	0.009	0.009*

* This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. This figure does not include the cost to include MCZ features in a MDP as it is not possible to break this down to each site. Instead it assumes that each dredge area's marine licence is renewed once every three years and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. The Scenario 2 cost is likely to be smaller for this rMCZ as the navigational dredge areas within 5km have MDPs.

Scenario 1: Future licence applications for navigational dredging within 1km of this site will be required to consider the potential effects of the activity on the features protected by the rMCZ.

	Scenario 2: Future licence applications for navigational dredging within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. An additional cost will arise to update the existing MDP to consider the potential effects of activities on the features protected by the rMCZ. The anticipated additional cost in the MDPs is estimated to be a one-off cost of £8438.Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2d. Recreation	**rMCZ 13, Sefton Coast**
Source of costs of the rMCZ	
Management scenario 1: Prohibition of recreational activities in areas of peat and clay exposures.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Sefton coast is popular for beach users (up to 300,000 visitors/yr). Activities include walking, kite surfing, horse riding and shore angling. (North West Coastal Forum, pers. comm., 2011). Recreational activities are known to take place in the area of the peat and clay exposures.	Due to the changeable locations of peat and clay exposures in this site (due to variable sand deposition and tidal range), it will be difficult to enforce prohibition of recreational activities in the area of peat and clay exposures in the site. It is more likely that discouragement of activities (through the use of signs) in the area of peat and clay exposures will be achieved. It is anticipated that participants in recreational activities will respond by carrying out their activities elsewhere in the site, or along the coast, and that this will have little or negligible impact on them and the quality of their recreational experience. Costs of signs are included in assessment of management costs (see Annex N).

Table 2e. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 13, Sefton Coast**
Oil and gas related activities (including carbon capture and storage)	
This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 13, Sefton Coast**
Flood and coastal erosion risk management (coastal defence), recreation, shipping and water pollution from activities on land. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Research and education	**rMCZ 13, Sefton Coast**	
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Peat and clay exposures are an important archaeological resource which may potentially provide historical and environmental data about human activity.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4b. Non-use and option values	**rMCZ 13, Sefton Coast**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. The Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), 12 'nominated sites' fall within the boundary of rMCZ 13. Nominations were made by recreational sea users who selected 'walking' and 'wildlife watching' as uses of the site; they mostly cited 'spectacular scenery' and 'ease of access' as reasons to protect the site. Another reason for	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Non-use and option values		**rMCZ 13, Sefton Coast**
	nominating the site was because it was felt that protection would lead to the increase of fish and shellfish. Professionals from the environment sector selected trawling as the principal activity that should be excluded from the site, and one stakeholder from this sector indicated that the site should be protected from noise pollution. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H). A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. All six members of the public who commented on the potential designation of rMCZ 13 said it was a 'good' or 'very good' idea. Reasons stated included the need to conserve and protect the 'irreplaceable' peat and clay beds.	

Recommended Marine Conservation Zone (rMCZ) 14, Hilbre Island Group — Site area (km^2): 4.49

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 14, Hilbre Island Group**

1a. Ecological description

This site surrounds an archipelago of three islands – Little Eye, Middle Eye (also known as Little Hilbre) and Hilbre Island – at the mouth of the Dee Estuary, adjacent to the town of West Kirby on the Wirral peninsula. The islands are connected to the mainland at low tide, when they can be accessed by foot. This is a popular activity with tourists, especially in the summer months. The islands are surrounded to the north-west by a 5–10 metre deep channel which was formed towards the end of the last Ice Age. It overlaps with a Site of Special Scientific Interest (SSSI), a Special Area of Conservation (SAC), a Special Protection Area (SPA) and a local nature reserve. The site proposes protection of blue mussel *Mytilus edulis* beds and peat and clay exposures.

Peat and clay exposures are an irreplaceable habitat type, as they are composed of former lake bed sediments and ancient forested peatland (also referred to as 'submerged forests') (Maddock (2010) in ISCZ, 2011). Depending on the level of sand scour present, the surface of peat exposures can be covered with algal mats made of red and green seaweeds *Ceramium* sp. and *Ulva lactuca* and *Ulva intestinalis*. Hydroids can be present within small pools of water and crabs shelter within crevices, e.g. shore crabs *Carcinus maenas* and edible crabs *Cancer pagurus* (Maddock (2010) in ISCZ, 2011). On the surface of clay exposures there tends to be less seaweed coverage; instead, small clumps of blue mussels *Mytilus edulis* can be present, alongside barnacles and periwinkles *Littorina littorea*, while polychaete worms live within the clay, e.g. *Polydora* sp. and *Hediste diversicolor* (Maddock (2010) in ISCZ, 2011). Both peat and clay exposures are soft enough to be burrowed into by piddocks *Pholas dactylus*, and the holes created by these burrowing bivalves provides an important microhabitat for species such as crabs and anemones, e.g. the daisy anemone *Cereus pedunculatus* and the gem anemone *Aulactinia verrucosa* (Maddock (2010) in ISCZ, 2011).

Blue mussel beds support a varied biological community. They provide a stable, hard substrate in areas of otherwise soft sediments or unstable rocky ground; this underlies their ecological importance. They stabilise the sediment, forming hard structures to which other sessile (or immobile) organisms can attach. The crevices they create can give shelter to other animals, and the accumulated faeces and associated sediments are an important food source for other species (Holt and others (1998) in ISCZ, 2011).

There are a number of additional habitat Features of Conservation Importance (honeycomb worm *Saballaria alveolata* reefs, intertidal mudflats and estuarine rocky habitats) which also occur within this proposed site; however, as they already receive protection through the existing SSSI, SAC and SPA they are not included as a feature within this rMCZ.

Three studies in the 1970s recorded the seaweed communities present on the rocky shores of Hilbre Island (Russell (1972a, 1972b, 1977) in ISCZ, 2011). Due to a combination of the limited availability of rocky substrate and the large tidal range, the intertidal communities can be split between two zones: the higher shore level contains *Prasiola stipitata*, *Blidingia minima*, *Lyngbya* spp. – all green seaweeds which grow in patches on rocks – while, on the lower shore, the acorn barnacle *Elminius modestus* and *Fucus* sp., brown algae can be found (Russell (1972a) in ISCZ, 2011). Laminarians or kelp species which were historically present have disappeared from this area and this has been attributed to pollution and/or siltation from the estuary (Russell (1972a) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ

Broadscale Habitats				
Intertidal Biogenic Reefs	0.46	-	Unfavourable condition	Recover to favourable condition
Habitats of conservation Importance				
Blue Mussel Beds	0.02	3	Unfavourable condition	Recover to favourable condition
Peat and Clay Exposures	0.02	1	Unfavourable condition	Recover to favourable condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the MCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 14, Hilbre Island Group**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed. However, restrictions could also be placed upon archaeological excavation in areas of peat and clay exposures in the site.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Over 10 wrecks are recorded in the site (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated. If archaeologists respond to restrictions on excavation in areas of peat and clay exposures by undertaking an alternative archaeological excavation in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the Impact Assessment (IA). If archaeological excavations do not take place as a result of this restriction, this will prevent interpretation of archaeological evidence from the site which will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 2b. Commercial fisheries **rMCZ 14, Hilbre Island Group**

Source of costs of the rMCZ

The Joint Nature Conservation Committee (JNCC) and Natural England have advised that there is considerable uncertainty about whether additional management of bottom trawling, hooks and lines, nets, pots and traps and the use of hooks and lines will be required for certain features potentially protected by the rMCZ. Therefore, two scenarios have been employed in the IA for these fisheries to reflect this uncertainty: no additional management, and closure of the fishery within the site. Should the site be designated, the management required will fall somewhere within this range.

Management scenario 1: Entire rMCZ is open to all gear types.

Management scenario 2:*** Closure of areas of blue mussel beds for hand collection of shellfish and bait digging.

Management scenario 3:***** Closure of areas of peat and clay exposures to bottom trawls, hooks and lines and nets, and collection by hand.

* This is the management scenario identified by the vulnerability assessment using information collected from stakeholders.

** Natural England and JNCC advise that bottom trawls, hooks and lines and nets, and collection by hand need to be managed in the vicinity of peat and clay exposures only, but for ease of analysis, and as the locations of peat and clay exposures are not fully known at this time, the loss of landings estimate represents the loss of landings from the entire rMCZ. As such, the estimate of landings affected will be an overestimate.

Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2007–10), at least 11 UK vessels are known to fish in the vicinity of rMCZ 14 (under 15 metre vessels only) (ISCZ, 2010). The vessels mostly beam trawl for shrimp and whitefish in the channel between Hilbre Island and the West Hoyle sandbank (which is outside of the rMCCZ) but very little activity, if any, takes place in rMCZ 14 itself and in the vicinity of the sensitive habitats (North Wales and Wirral fishers, pers. comm., 2011). The gear used is lighter than conventional offshore beam trawling gear (Stakeholder Focus Meeting, 2011). There is no evidence for the use of dredges or pots and traps in the site. At least seven fishers are known to regularly hand-pick in and around the site for mussel and cockle (ISCZ, 2010); however, this depends on the occurrence of mussel and cockle spat and when the beds are opened to harvesting. At such times, the numbers of fishers hand-picking in the site can greatly increase. The estimated total value of UK landings from the site is £0.057m/yr (including shellfish collected by hand), but in years when shellfish spats occur and the beds are opened for commercial gathering the value can increase to £5m to £10m/yr (based on an internet search for media reports covering the last ten years). This is provided for each affected gear type below.

It should be noted that the Liverpool Special Protection Area (SPA) overlaps with rMCZ 14. It is not yet known what the fisheries restrictions for the SPA will be but the management scenarios employed in the IA for the SPA were no additional restrictions (minimum scenario) or the maximum scenario:

- Closure of high density areas of common scoter to beam trawling and dredging as well as reduction in effort for gears targeting the prey of common scoter.
- Seasonal closure of high density areas of red-throated diver to specified nets, beam trawling and dredging as well as reduction in effort for gears targeting the prey of red-throated divers.

It is not known for the purposes of this IA, if high density areas of either common scoter or red-throated diver are located within rMCZ 14.

Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: At least seven vessels are known to use beam trawls in the site, targeting shrimp, sole, plaice, flounder, turbot, and skate and ray throughout the year (ISCZ, 2010). The vessels mostly beam trawl for shrimp and whitefish in the channel between Hilbre Island and the West Hoyle sandbank but very little activity, if any, takes place in rMCZ 14 itself and in the vicinity of the sensitive habitats (North Wales and Wirral	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 | Scenario 3 Value of landings affected | 0.000 | 0.000 | 0.001 ***Scenario 3*****:** Closure of the site to beam trawling could impact on the nine local families that fish in the vicinity of the rMCZ. Stakeholders have not provided a description of impact. In establishing the draft conservation

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th>rMCZ 14, Hilbre Island Group</th></tr>
<tr><td colspan="2">fishers, pers. comm., 2011). The gear used is lighter than conventional offshore beam trawling gear (Stakeholder Focus Meeting, 2011).
Beam trawling in the vicinity of rMCZ 14 is very important to the local community and has been taking place for hundreds of years. This is because generations of approximately nine local families depend on the fishing for their livelihoods. Consequently, this fishing activity is of very local significant economic and social importance (North Wales fisher, pers. comm., 2011).
The estimated value of landings from the site is £0.001m/yr.</td><td>objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with bottom trawls at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><td colspan="2">Hooks and lines: Fewer than five vessels are known to use static lines in the site to target bass throughout the year (ISCZ, 2010).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with hooks and lines at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><td colspan="2">Nets: At least ten vessels known to use nets in the site (ISCZ, 2010). They use gill nets, trammel nets, drift nets and tangle nets to target bass, sole, flounder, mullet, plaice and salmonid throughout the year.
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.000</td><td><0.001</td></tr></table>Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant. Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been assessed as having low vulnerability to fishing with nets at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><td colspan="2">Hand collection of shellfish and bait digging: Fewer than five intertidal fishers are known to pick mussel in the site (ISCZ, 2010). The North Western Inshore Fisheries and Conservation Authority (NWIFCA) believes there to be little or no commercial picking in the site. The activity is managed by NWIFCA.
The estimated value of landings from the site is £0.055m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.055</td><td>0.055</td></tr></table>Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant. Stakeholders have not provided a description of impact. In establishing the draft conservation objectives, sensitive features in the rMCZ may have been</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th>rMCZ 14, Hilbre Island Group</th></tr>
<tr><td colspan="2">The FisherMap data for intertidal fisheries are the best available data. However, confidence in the data is low as, on the one hand, they are overestimates because the fishing grounds mapped by fishers represent areas greater in size than the rMCZ and will include values for nearby valuable cockle and mussel fishery areas. On the other hand, not every intertidal fisher has been interviewed, although we estimate about 30% of regular north-west of England intertidal fishers provided data. It should also be noted that values are only indicative due to the inherent unpredictability of where and when cockle and mussel spats will occur, and whether they will be opened for harvesting. Also, because the numbers of people attracted to cockle and mussel beds when they are opened is so unpredictable and difficult to manage, the real economic value of these beds is very hard to estimate. In the north-west of England waters, trends indicate that usually one large bed is opened once every four to five years, each worth in the region of £5m to £10m/yr (based on an internet search for media reports covering the last ten years).</td><td>assessed as having low vulnerability to collection by hand at current levels. Where this is the case, this activity was not the primary reason for assigning 'recover' conservation objective(s). As such, it is anticipated that if management is required it may be towards the lower end of the range, and is likely to be less restrictive than that required for other gears.</td></tr>
<tr><th colspan="3">Total direct impact on UK commercial fisheries</th></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table>
<tr><th>£m/yr</th><th>Scenario 1</th><th>Scenario 2</th><th>Scenario 3</th></tr>
<tr><td>Value of landings affected</td><td>0.000</td><td>0.055</td><td>0.056</td></tr>
<tr><td>GVA affected</td><td>0.000</td><td>0.025</td><td>0.026</td></tr>
</table>
At least ten vessels and five intertidal fishers are likely to be affected (ISCZ, 2010). In years when there is significant mussel spat which is opened for harvesting, the numbers of intertidal fishers affected will be much greater. Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 0
Scenario 2: 0
Scenario 3: 10</td></tr>
<tr><th colspan="2">Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td colspan="2">Impact on non-UK commercial fisheries: There is no evidence of non-UK vessels working in this site (MMO, 2011a).</td><td>None.</td></tr>
</table>

Table 2c. Ports, harbours, shipping and disposal sites **rMCZ 14, Hilbre Island Group**

Source of costs of the rMCZ

Management scenario 1: Not applicable to this site.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Disposal sites: There are three disposal sites within 5km of the rMCZ (Dee Estuary, Mostyn Deep, Mostyn Deep (maintenance)). These are associated with the ports of Mostyn and the Dee Estuary. The sum of the average number of licence applications received for all of these disposal sites in total is 0.5 per year (based on number of licence applications received between 2001 and 2010 (Cefas, pers. comm., 2011). ***Port development:*** The port of Hoylake is within 5km of the rMCZ. No port developments are known to be planned within the 20-year period of the IA.	<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.000</td><td>0.004*</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. ***Scenario 1*:** Not applicable. ***Scenario 2*:** Future licence applications for disposal of dredged material and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2d. Recreation **rMCZ 14, Hilbre Island Group**

Source of costs of the rMCZ

Management scenario 1: Prohibition of recreational activities in areas of peat and clay exposures and blue mussel beds.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Many thousands of tourists each year walk across at low tide to Hilbre Island. Horse riders sometimes go across to Hilbre Island also. Rockpooling is popular in some parts of the island. These activities mostly take place away from the present known location of the blue mussel beds and peat and clay exposures. However, some recreational activities may take place on these features and could impact on the features. The area of peat and clay exposures in this site is fairly contained. Information was not available on the types of activities that currently take place in areas of peat and clay exposures and blue mussel beds. (North West Coastal	The level of recreational activity taking place in the area of the peat and clay exposures and the blue mussel beds in the site is low. It may be difficult to enforce prohibition of recreational activities in the area of peat and clay exposures and blue mussel beds in the site. It is more likely that activities will be discouraged (through the use of signs) in the areas of these sensitive features. It is assumed that participants in recreational activities will respond to the signs by carrying out their activities elsewhere in the site, or along the coast and that this will have a negligible impact on the participants and the quality of their recreational experience. Costs of signs are included in assessment of management costs (see Annex N).

Table 2d. Recreation	**rMCZ 14, Hilbre Island Group**
Source of costs of the rMCZ ***Management scenario 1:*** Prohibition of recreational activities in areas of peat and clay exposures and blue mussel beds.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Forum, pers. comm., 2011).	

Table 2e. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 14, Hilbre Island Group**
Cables (interconnectors and telecom cables) Future interconnectors and telecom cables may pass through the rMCZ. Impacts of rMCZs on future interconnectors and telecom cables are assessed in the Evidence Base, Annex H6 and Annex N3 (they are not assessed for this site alone).	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 14, Hilbre Island Group**
Existing cables (telecom cables), flood and coastal erosion risk management (coastal defence) and water pollution from activities on land. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 14, Hilbre Island Group**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Fishing vessels in the site mostly beam trawl for shrimps and whitefish in the channel between Hilbre Island and the West Hoyle sandbank but very little activity, if any, takes place in rMCZ 14 itself (North Wales & Wirral fishers, pers. comm., 2011). The gear used is lighter than conventional offshore beam trawling gear (Stakeholder Focus Meeting,	If the conservation objectives of the features are achieved, the features will be recovered to a favourable condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to either hand-picking around the blue mussel beds or prohibition of bottom trawls, hooks and lines, nets and collection	Anticipated direction of change: ⇔ Confidence:

Table 4a. Fish and shellfish for human consumption		**rMCZ 14, Hilbre Island Group**
2011). There is no evidence for the use of dredges or pots and traps in the site. Intertidal fishers hand-pick in and around the site for mussels and cockles (ISCZ, 2010). See Table 2 for more detail. Biogenic reefs provide habitat for shellfish and fish, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)). They are also likely to support shrimp fishing (Holt and others (1998) in Fletcher and others (2012)) and bivalves spats such as mussels, cockles and scallops (OSPAR (2008), Bolam (2003); both in Fletcher and others (2012)). Biogenic reefs also support crabs, lobsters, queen scallops and other crevice-dwelling fauna (Hill (1998) in Fletcher and others (2012); Lancaster (2008) in ISCZ (2011)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	by hand around peat and clay exposures respectively. Therefore, there will be no benefits to fishers using these gear types in these parts of the site. However, spill-over effects could generate benefits for vessels fishing within or just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). However, due to the size of the areas where fishing is likely to be restricted, and the likelihood that little fishing, if any, currently takes place in these parts of the site, the anticipated benefits to fisheries is minimal. The blue mussel beds are already managed by the North Western Inshore Fisheries and Conservation Authority (NWIFCA). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, additional mitigation would be introduced, with the associated costs and benefits).	Moderate

Table 4b. Regulating services		**rMCZ 14, Hilbre Island Group**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Intertidal biogenic reefs also filter large volumes of water (Dubois (2006); Forster (1995); Rabaut (2010) in Fletcher and others (2012)). The filter feeding of biogenic reefs is such that they affect energy flow over a much wider area than the reef itself (Holt and others (1998) in Fletcher and others (2012)). They play a key role in organic matter processing and nutrient cycling (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Biogenic reefs increase the habitat complexity of the surrounding	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ 14, Hilbre Island Group**
environment and provide microhabitats for other organisms in crevices and cavities (Hill (2010) in Fletcher and others (2012)). Blue mussel beds in areas of soft sediment provide an area of hard substrata (Hill, 2010) and create complex habitats that provide refuge for a range of flora and fauna not observed on surrounding sediments (Hill (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (McManus (2001), Riding (2002); both in Fletcher and others (2012)).		

Table 4c. Recreation		**rMCZ 14, Hilbre Island Group**
Baseline	**Beneficial impact**	
Many thousands of tourists each year walk across at low tide to Hilbre Island. Horse riders also sometimes cross to the island. Rockpooling is popular in some parts of the island. The concentration of these activities take place away from the present known location of the blue mussel beds and peat and clay exposures. Fletcher and others (2011) report that the features to be protected by the rMCZ can contribute to the delivery of recreation and tourism services. In particular, blue mussel beds are noted as an important food source for birds such as knots, turnstones, sandpipers, herring gulls, crows and scoters (Nehls and Thiel (1993, cited in Tyler- Walters, 2008) in ISCZ, 2011) which will benefit bird watchers. The MCZ features (e.g. intertidal biogenic reefs) will also provide biological processes that support various fish species that in turn will benefit anglers. The baseline quantity and quality of the ecosystem service provided is assumed to be commensurate with that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Due to the ecological services of features to be recovered in the site, MCZ designation may lead to an increase, in time, of anglers and bird watchers to the site, which may benefit the local economy. Various studies demonstrate the local economic value of sea angling (Scottish Government, 2009; Invest in Fish South West, 2005); however, it has not been possible to quantify the potential impact for this rMCZ. Sea birds are known to attract visitors, which in turn generates local economic value. A study of four Royal Society for the Preservation of Birds (RSPB) marine reserves has highlighted the fact that, on average, an estimated additional income of £300,000 a year can be generated and directly attributed to sea bird watching within a designated nature reserve (RSPB, 2010). On average, this has supported up to the equivalent of an additional nine full-time jobs at each reserve. While this is the estimated local economic value generated in the absence of MCZs, it emphasises that MCZs could provide ecological benefits for sea birds which in turn could generate local economic value if sea bird numbers increase or are given more protection. However, it is not clear from the research	Anticipated direction of change: ⇔ Confidence: Moderate

Table 4c. Recreation		**rMCZ 14, Hilbre Island Group**
	if economic value is likely to increase with sea bird numbers or additional protection. It is, however, likely that a better quality of experience (i.e. more sea birds) would attract more visitors. Regardless, such impacts are likely to be localt and represent a redistribution of sea bird watching rather than an overall increase in bird watchers nationally. The ecological and recreational benefits potentially provided by this rMCZ would complement the existing Hilbre Nature Reserve which overlaps with the rMCZ. As the site is already part of the Dee Estuary SAC and Hilbre Island Nature Reserve, the anticipated additional benefits of this rMCZ are minimal.	

Table 4d. Research and education		**rMCZ 14, Hilbre Island Group**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Peat and clay exposures are an important archaeological resource which may potentially provide historical and environmental data about human activity.	Monitoring of the rMCZ will help inform understanding of how the marine environment is changing and how it is impacted on by anthropogenic pressures and management interventions. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4e. Non-use and option values		**rMCZ 14, Hilbre Island Group**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4e. Non-use and option values		**rMCZ 14, Hilbre Island Group**
	In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), three 'nominated sites' fall within the boundary of rMCZ 14. Nominations were made by recreational users who cited the presence of 'whales, dolphins, seals and sharks' and the spectacular scenery of the site as reasons for protecting the it. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H). A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of five members of the public who commented on the potential designation of rMCZ 14, three said it was a 'good' or 'very good' idea. Reasons stated included the need to conserve and protect marine biodiversity, in particular birdlife.	

Recommended Marine Conservation Zone (rMCZ) 15, Solway Estuary — Site area (km^2): 45.72

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ 15, Solway Estuary**

1a. Ecological description

This site is located in the Solway Firth Estuary, Cumbria, in the far north-eastern Irish Sea. The site extends from the shore to the middle of the estuary where the boundary between English and Scottish waters is positioned. The site falls within the Solway Firth Special Area of Conservation (SAC), which delivers protection to many of the benthic features throughout the site, such coastal saltmarshes which are important nursery areas for a range of fish species, including bass. The site has been selected as a representative area where there are records of both spawning smelt *Osmerus eperlanus* (upstream) and European eel *Anguilla anguilla*. On a national level, both smelt and eel have been subject to declines in abundance. Historically, smelt were common in the Solway and were the target of a large fishery. Little is known about the current abundance of eel in the Solway but, based on their ubiquitous distribution across river estuaries in the UK, they are likely to be present. Smelt and eel are already afforded de facto protection from the existing fisheries management regulations (Inshore Fisheries and Conservation Authorities (IFCA) byelaws) that are in place to conserve river and sea lamprey and salmon (ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Species of Conservation Importance				
Smelt	-	-	Favourable condition	Maintain at favourable condition
Eel	-	-	Favourable condition	Maintain at favourable condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage — **rMCZ 15, Solway Estuary**

Source of costs of the rMCZ

Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.

Baseline description of activity	Costs of impact of rMCZ on the sector
World War II military aircraft wrecks and numerous vessel wrecks are recorded in the site. The site also abuts Hadrian's Wall (World Heritage Site), Kirtlebridge, Annan and Brayton branch railway and the medieval port at Sandfields. A former naval airfield, known as HMS *Nuthatch*, borders the site (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Ports, harbours, shipping and disposal sites **rMCZ 15, Solway Estuary**

Source of costs of the rMCZ

Management scenario 1: Not applicable to this site.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	Costs of impact of rMCZ on the sector
Disposal sites: There is one disposal site within 5km of the rMCZ, associated with the port of Silloth. No licence applications were received for this disposal site between 2001 and 2010 but it is not closed to disposal in the future (Cefas, pers. comm. 2011)). ***Port development:*** The port of Silloth is located within 5km of the rMCZ. No port developments are known to be planned within the 20-year period of the IA.	*£m/yr* / Scenario 1 / Scenario 2 Cost to the operator / 0.000 / <0.001* * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. ***Scenario 1*:** Not applicable. ***Scenario 2:*** Although the disposal site rMCZ has not been used in the last ten years, it might be used during the 20 year period covered by the IA. Future licence applications for disposal of dredged material and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 3. Human activities in the site that are not negatively affected by the MCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 15, Solway Estuary**
All with the exception of archaeology, ports, harbours and shipping. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 15, Solway Estuary**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). European eels are fished commercially, but over-harvesting has contributed to the decline in eel numbers, as has pollution, hydropower dams and parasites. The quantity of juvenile eels has been reduced to no more than 5% of the numbers recorded in the 1970s. The number of adults is thought to have declined by 80% in the past 60 years. Once in decline, their numbers take a long time to recover, as is the case with other long-lived, slow-growing animals (Fletcher and others (2012)). Smelt *Osmerus eperlanus* are commonly found in coastal areas of the UK, including in transitional waters. Consequently, artisanal fisheries that operate in these areas may regularly exploit them (Maitland (2003) in Fletcher and others (2012)). Local populations may be vulnerable to high fishing pressure. The captured fish are used for eating and for baits used in recreational angling (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No additional management (above that in the baseline situation) of fishing activities is expected. As such, no benefits are expected to accrue as a result of reduced fishing mortality. No change in on-site feature condition or fishing mortality is anticipated and therefore no impact on on-site or off-site benefits is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⇔ Confidence: Low

Table 4b. Non-use and option values		**rMCZ 15, Solway Estuary**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), four 'nominated sites' fall within the boundary of rMCZ 15. All nominations cited the protection of 'whales, dolphins, basking sharks, seals' (i.e. animals) and the 'spectacular scenery' as reasons for their nomination. All nominations also indicated their belief that site protection is needed for 'fish and shellfish numbers [to] increase'. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H).	Anticipated direction of change: ⇧ Confidence: Low

Recommended Marine Conservation Zone (rMCZ) 16, Wyre-Lune Estuary — Site area (km^2): 92.38

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts				**rMCZ 16, Wyre-Lune Estuary**
1a. Ecological description				
This rMCZ is comprised of two estuaries – the Wyre and the Lune – that are situated in Morecambe Bay, Lancashire. The site itself extends 9km seawards from the inner shore to the outer sea boundary. The features proposed for designation are two highly mobile species; smelt *Osmerus eperlanus* and European eel *Anguilla anguilla*. Both estuaries have saltmarsh habitats which are important fish nursery areas for a range of species. The Lune Estuary falls within the Morecambe Bay Special Area of Conservation (SAC), which already protects the benthic features throughout the site. The Wyre Estuary is not protected by an SAC; the saltmarshes are protected by the Site of Special Scientific Interest (SSSI) designation, but this offers a lower level of protection. The potential nursery areas in the Lune extend up to the Skerton weir. These nursery grounds are important for herrings, sprats and flounders (ISCZ, 2011). Source: ISCZ (2011).				
1b. MCZ Feature Baseline and Impact of MCZ				
Feature	**Area of feature (km^2)**	**No. of point records**	**Baseline**	**Impact of MCZ**
Species of Conservation Importance				
Smelt	-	-	Favourable condition	Maintain at favourable condition
Eel	-	-	Favourable condition	Maintain at favourable condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 16, Wyre-Lune Estuary**
Source of costs of the rMCZ	
Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Over 100 records for aircraft and vessel wrecks are recorded in the site. Medieval	An extra cost would be incurred in the assessment of environmental impact made in

and post-medieval sea defences and a fish trap are also recorded within the site. Peat is recorded at Fleetwood. It is not clear if this is within the site (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the future as it is relevant to its National Heritage Protection Plan (theme 3A1.2).	support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Ports, harbours, shipping and disposal sites **rMCZ 16, Wyre-Lune Estuary**

Source of costs of the rMCZ

Management scenario 1: Increase in costs of assessing environmental impacts for future licence applications within 1km of an rMCZ. This applies to future navigational dredging and disposal of dredge material only. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities relative to the mitigation provided in the baseline.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. Additional costs incurred in updating existing Maintenance Dredging Protocol (MDP). It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Disposal sites: There are two disposal sites within 1km of the rMCZ (Morecambe Bay-Lune Deep and Lune River B) that are licensed for disposal of channel dredge material. These are likely to be used by the port of Fleetwood. The sum of the average number of licence applications received for all of these disposal sites in total is 1.2 per year (based on number of licence applications received between 2001 and 2010 (Cefas, pers. comm., 2011). There are seven disposal sites within 5km of the rMCZ that are licensed for disposal of channel dredge material. These are likely to be used by the ports of Glasson Dock, Fleetwood and, potentially, Heysham. The sum of the average number of licence applications received for all of these disposal sites in total is 1.6 per year (based on number of licence applications received between 2001 and 2010 (Cefas, pers. comm., 2011). ***Navigational dredge areas:*** There is one licensed navigational dredge area within 1km (and therefore within 5km) of this rMCZ associated with the port of Fleetwood. It is assumed that each dredge area's marine licence is renewed once every 3 years, and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. As this navigational dredge area is covered by an existing MDP,	<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.010</td><td>0.014*</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. This figure does not include the cost to include MCZ features in a MDP as it is not possible to break this down to each site. Instead it assumes that each dredge area's marine licence is renewed once every three years and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. The Scenario 2 cost is likely to be smaller as the navigational dredged area within 1km of this rMCZ is covered by a MDP. ***Scenario 1:*** Future licence applications for disposal of dredged material, navigational dredging and known port or harbour development plans or proposals within 1km of this site will be required to consider the potential effects of the activity on the features protected by the rMCZ. A breakdown of costs by activity by site is provided in Annex N. ***Scenario 2:*** Future licence applications for disposal of dredged material, navigational dredging and known port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. An additional cost will arise to update the existing MDP to consider the potential effects of activities on the

it is assumed that the assessment of environmental impact is not changed over the 20 year period of the IA. ***Port development:*** There are three ports within 5km of this rMCZ: Heysham, Fleetwood and Lancaster. No port developments are known to be planned within the 20-year period of the Impact Assessment (IA).	features protected by the rMCZ. The anticipated additional cost in the MDP is estimated to be a one-off cost of £8438. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise. ABP (pers. comm., 2012) operate the Port of Fleetwood and anticipates that the designation of rMCZ 16 could incur an additional one-off cost in the region of £0.085m to £2.810m over the period 2019 to 2025. This cost would arise for a theoretical future port development and is expected to comprise the following: • Additional surveys of smelt and eel populations. • Underwater noise and sediment modelling to assess the impact of percussive piling upon smelt and eel populations. • Costs could be incurred if mitigation of impacts of dredging plumes or percussive piling is required. These could include costs of measures such as timing controls, changes in methods or dredging rates and/or change in disposal location. The Port of Fleetwood also anticipates annual costs of £0.200m to £1.000m would arise as a result of to MCZ 16 (for a theoretical future port development) associated with the following: • Implementation of a long-term monitoring programme to assess the impact of the port development on eels and smelt. • Mitigation/offsetting measures to address any residual uncertainty in impacts (e.g. payment to improve smelt spawning habitat, payment for installation of eel passes upriver etc.). These concerns are set out in more detail in Annexes H, J and O. An industry assessment of the costs at the national level is provided in the Evidence Base. (ABP, pers. comm., 2012).

Table 2c. Renewable energy	**rMCZ 16, Wyre-Lune Estuary**
Source of costs of the rMCZ ***Management scenario 1:*** Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline). ***Management scenario 2:*** Increase in costs of assessing environmental impacts for licence applications and increase in cable protection installation costs for power export cables and inter-array cables (relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
It is estimated that 6.5km of the proposed and yet to be consented export power cable route for the Walney	The estimated cost to renewable energy developers operating in this rMCZ is expected to fall within the following range of scenarios:

Table 2c. Renewable energy	**rMCZ 16, Wyre-Lune Estuary**
Extension wind farm passes along the boundary of the site.	

£m/yr	Scenario 1	Scenario 2
Cost to the operator	0.000	0.325
GVA affected	0.000	0.325

Scenario 1: The licence application for the Walney Extension wind farm cable route will need to consider the potential effects of the development on achieving the conservation objectives of the rMCZ's features. This is expected to result in an additional one-off cost of £0.004m in 2013 (for extra consultant/staff time).

Scenario 2: In addition to the increased costs for assessment set out under Scenario 1, Scenario 2 includes costs of additional mitigation. This additional mitigation entails use of alternative cable protection for export cables and inter-array cables that have not yet been consented. This is expected to result in an additional one-off cost of £6.5m in 2013 (based on estimated additional cost of £1m/km of power export cable only). No inter-array cabling is anticipated to be required in this rMCZ because no existing or planned wind farm developments overlap directly with this rMCZ. These costs are included in Scenario 2 to reflect uncertainty over whether this additional mitigation will be required. However, JNCC and Natural England (pers. comm., 2012) state that the likelihood of this cost occurring is very low. Further details are provided in Annex H14.

The impacts that are assessed in both scenarios are based on JNCC and Natural England's advice on the mitigation that could be required.

Comments from DONG Energy: DONG Energy (the wind farm developer for Walney Extension wind farm) is concerned that additional costs will be incurred in the Environmental Impact Assessment (EIA) in support of the application for consent for the cable route for the Walney Extension wind farm. It anticipates that this will comprise additional surveys and data collection as well as consideration of the impact of the development upon rMCZ features in the site. DONG Energy is also concerned about additional requirements for measures to mitigate the impact of the proposed development upon the rMCZ features, compared with measures that would be undertaken in the absence of the rMCZ as a condition of the marine licence. The developer did not provide a cost estimate for this anticipated impact for this site. (DONG Energy, pers. comm., 2012)

Table 2d. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ 16, Wyre-Lune Estuary**

Oil and gas related activities (including carbon capture and storage)

This rMCZ overlaps with an area that has potential for future oil and gas exploration and production (it overlaps licensed blocks in the 26th or 27th Seaward Licensing Rounds). However, the area is not necessarily viable to develop. Impacts of rMCZs on the oil and gas related activities are assessed in the Evidence Base, Annex H11 and Annex N10 (they are not assessed for this site alone).

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 16, Wyre-Lune Estuary**
All with the exception of archaeology, ports, harbours and shipping. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 16, Wyre-Lune Estuary**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). European eels are fished commercially, but over-harvesting has contributed to the decline in eel numbers, as has pollution, hydropower dams and parasites. The quantity of juvenile eels has been reduced to no more than 5% of the numbers recorded in the 1970s. The number of adults is thought to have declined by 80% in the past 60 years. Once in decline, their numbers take a long time to recover, as is the case with other long-lived, slow growing animals (Fletcher and others (2012)). Smelt *Osmerus eperlanus* are commonly found in coastal areas of the UK, including in transitional waters. Consequently, artisanal fisheries that operate in these areas may regularly exploit them (Maitland (2003) in Fletcher and others (2012)). Local populations may be vulnerable to high fishing pressure. The captured fish are used for eating and for baits used in recreational angling (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No additional management (above that in the baseline situation) of fishing activities is expected. As such, no benefits are expected to accrue as a result of reduced fishing mortality. No change in on-site feature condition or fishing mortality is anticipated and therefore no impact on on-site or off-site benefits is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⇔ Confidence: Low

Table 4b. Non-use and option values		**rMCZ 16, Wyre-Lune Estuary**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), 11 'nominated sites' fall within the boundary of rMCZ 16. The most cited reason for protecting this site was the personal attachment stakeholders felt towards it. Other reasons for protecting the site were the proximity and ease of access of the area to the stakeholders. The majority of people nominating sites in this rMCZ wanted to see the site set up in order to bring about an 'increase in fish and shellfish' numbers. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H).	Anticipated direction of change: ⇧ Confidence: Low

Recommended Marine Conservation Zone (rMCZ) 17, Ribble Estuary — Site area (km^2): 12.70

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts				**rMCZ 17, Ribble Estuary**
1a. Ecological description				
This site is located in the Ribble Estuary on the Lancashire coast. It is proposed in order to protect two highly mobile species: smelt *Osmerus eperlanus* and the European eel *Anguilla anguilla*. The Ribble Estuary is already protected through the Ribble Special Protection Area (SPA), and its designation as both a site protected under the Ramsar Convention and as a Site of Special Scientific Interest (SSSI). The Ribble Estuary also contains areas of ungrazed saltmarshes which are in good condition. The saltmarshes are of additional ecological importance as they provide the habitat for fish nurseries. Within the Ribble there is a small self-recruiting smelt population, which is believed to have a strong potential for recovery. There is no elver fishery in the estuary (ISCZ, 2011). Source: ISCZ (2011).				
1b. MCZ Feature Baseline and Impact of MCZ				
Feature	**Area of feature (km^2)**	**No. of point records**	**Baseline**	**Impact of MCZ**
Species of Conservation Importance				
Smelt	-	-	Favourable condition	Maintain at favourable condition
Eel	-	-	Favourable condition	Maintain at favourable condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ 17, Ribble Estuary**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline). Archaeological excavations, surface recovery, intrusive and non-intrusive surveys, diver trails and visitors will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Some 15 wrecked vessels are recorded in the site as well as two log boats (discovered 1887) (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the	An extra cost would be incurred in the assessment of environmental impact made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known, so no overall cost

future as it is relevant to its National Heritage Protection Plan (theme 3A1.2).	to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. No further impacts on activities related to archaeology are anticipated.

Table 2b. Ports, harbours, shipping and disposal sites **rMCZ 17 Ribble Estuary**

Source of costs of the rMCZ

Management scenario 1: Increase in costs of assessing environmental impacts for future licence applications within 1km of an rMCZ. This applies to future navigational dredging and disposal of dredge material only. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities relative to the mitigation provided in the baseline.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Disposal sites: There are two licensed sites used for the disposal of channel dredge material within 1km of the rMCZ. It is likely that these are associated with the port of Preston. No licence applications were received for this disposal site between 2001 and 2010 but it is not closed to disposal in the future (Cefas, pers. comm. 2011)). ***Port development:*** The port of Preston is located within 5km of the rMCZ. No port developments are known to be planned within the 20-year period of the Impact Assessment (IA).	

£m/yr	Scenario 1	Scenario 2
Cost to the operator	0.000	<0.001*

* This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information.

***Scenario 1*:** Although the disposal site rMCZ has not been used in the last ten years, it might be used during the 20 year period covered by the IA. Future licence applications for disposal of material in the disposal site will need to consider the potential effects of the activity on the features protected by the rMCZ. A breakdown of costs by activity by site is provided in Annex N.

Scenario 2: Although the disposal site rMCZ has not been used in the last ten years, it might be used during the 20 year period covered by the IA. Future licence applications for disposal of dredged material and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ 17, Ribble Estuary**
All with the exception of archaeology, ports, harbours and shipping. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ 17, Ribble Estuary**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). European eels are fished commercially, but over-harvesting has contributed to the decline in eel numbers, as has pollution, hydropower dams and parasites. The quantity of juvenile eels has been reduced to no more than 5% of the numbers recorded in the 1970s. The number of adults is thought to have declined by 80% in the past 60 years. Once in decline, their numbers take a long time to recover, as is the case with other long-lived, slow growing animals (Fletcher and others (2012)). Smelt *Osmerus eperlanus* are commonly found in coastal areas of the UK, including in transitional waters. Consequently, artisanal fisheries that operate in these areas may regularly exploit them (Maitland (2003) in Fletcher and others (2012)). Local populations may be vulnerable to high fishing pressure. The captured fish are used for eating and for baits used in recreational angling (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in a favourable condition.	If the conservation objectives of the features are achieved, the features will be maintained in a favourable condition. No additional management (above that in the baseline situation) of fishing activities is expected. As such, no benefits are expected to accrue as a result of reduced fishing mortality. No change in on-site feature condition or fishing mortality is anticipated and therefore no impact on on-site or off-site benefits is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⟺ Confidence: Low

Table 4b. Non-use and option values		**rMCZ 17, Ribble Estuary**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), three 'nominated sites' fall within the boundary of rMCZ 17. Recreational users were the sole contributors to these nominations; all cited the presence of a 'wide range of plants and animals' as a reason for site protection. They all perceived the area to be under threat. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H).	Anticipated direction of change: Confidence: Low

Recommended Marine Conservation Zone (rMCZ) Reference Area A, Mud Hole — Site area (km^2): 20.37

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area A, Mud Hole**

1a. Ecological description

Recommended MCZ Reference Area A is located within rMCZ 1. It comprises an area of deep water (26–38 metres) mud habitat located 21km/10 nautical miles (nm) off the Cumbrian coast in north-west England. This area of subtidal mud contains the following Features of Conservation Importance (FOCI) habitat types: mud in deep water and sea-pens and burrowing animals. These muddy habitats form part of the eastern Irish Sea mud patch, an area that is geographically isolated from the deep water mud habitat that is present in the western Irish Sea (Clements (2010) in ISCZ, 2011). The mud is of high commercial interest, as it is the habitat of the Dublin Bay prawn *Nephrops norvegicus*. There are, however, a number of other species which inhabit this sea bed type, including the brittlestar *Amphiura chiajei* and the burrowing sea urchin *Brissopsis lyrifera* as well as crabs, shrimps and other species. Due to the low light levels, no plants tend to grow at this depth. This means that the marine animals found within the sea bed are a key part of the food chain, linking energy from the plankton to higher trophic levels, such as predatory fish (Bolam and others (2010) in ISCZ, 2011).

Lumb and others (2011, in ISCZ, 2011) mapped the expected distribution of sea-pens and burrowing animals within this part of the Irish Sea. The expected distribution was inferred from survey data and from the presence of the suitable underlying habitat type (Hughes and Atkinson (1997) in ISCZ, 2011). Historically, sea-pens were abundant in this region (Jones and others (1952, cited in Swift, 1993 in ISCZ, 2011), but relatively recent video survey data indicated that they have become rare in this part of the eastern Irish Sea (Hughes and Atkinson (1997) in ISCZ, 2011). Designation of rMCZ Reference Area A may allow for the potential recovery of sea-pens and burrowing animals, a habitat type which is known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011). Source: ISCZ (2011).Source: ISCZ (2011)

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	20.37	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Mud Habitats in Deep Water	8.52	1	Unfavourable condition	Recover to reference condition
Sea-pen and Burrowing Animals	8.52	1	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage — **rMCZ Reference Area A, Mud Hole**

Source of costs of the rMCZ

Increase in costs of assessing environmental impacts for future licence applications. Archaeological excavations, surface recovery and intrusive surveys will be prohibited

from the entire site. Diver trails, visitors and non-intrusive surveys will be allowed.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Fishers have reported 8 unidentified objects that have caused obstruction to fishing gear in this site which may represent features of archaeological interest (English Heritage, pers. comm., 2012).	An extra cost would be incurred in the assessment of environmental impacts made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. If archaeologists respond to the prohibition of excavation by undertaking an alternative archaeological excavation in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the IA. The prohibition of excavation and therefore interpretation of archaeological evidence from the site will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 2b. Commercial fisheries **rMCZ Reference Area A, Mud Hole**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries apart from mid-water trawling, which is only prohibited in the part of the site which lies outside of 12 nautical miles (nm) only.

Management scenario 2: Closure of entire rMCZ to all commercial fisheries.

Summary of all UK commercial fisheries: The site straddles the 12nm limit offshore. A number of commercial fishing restrictions already exist in the site (listed in Annex E). The site is located on the edge of one of the two major nephrops fishing grounds in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011a). It is important to the Cumbrian and Northern Ireland fishing fleets in terms of value of landings. Of approximately 700 UK vessels that are known to be active in the ISCZ Project Area (MMO, 2011b), at least 30 UK vessels are known to fish in this site (both under and over 15 metre vessels) (ISCZ, 2010). Stakeholder meetings suggest that nearer to 70 vessels are active in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). The 30 UK vessels (both under and over 15 metre vessels) that are known to fish in the site use bottom trawls, mid-water trawls and dredges in the site, and target sole, prawn, plaice, pollack, shrimp, flatfish, whitefish, brill, solenette, turbot, rockfish, herring, skate and ray, scallop, cod, haddock and monkfish. These vessels are associated with the home ports of Ardglass, Bangor, Barrow, Fleetwood, Kilkeel, Maryport, Portavogie and Whitehaven (ISCZ, 2010). Vessel Monitoring System (VMS) data indicate the use of bottom trawls, dredges and mid-water trawls by over 15 metre UK vessels in the area (MMO, 2011a). There is no evidence of other gear types being used in the site. The estimated total value of UK landings from the site is £0.327m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: At least 25 UK vessels are known to use bottom trawls (single-rig, twin-rig and pair) in the site (ISCZ, 2010). These vessels target sole, prawn, plaice, pollack, shrimp, flatfish, whitefish, brill, solenette, turbot, rockfish, skate and ray, cod, haddock and monkfish throughout the year. They are associated with	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 Value of landings affected | 0.257 | 0.257 ***Comments from representatives of the Northern Ireland fishing fleet:*** *Regarding Scenarios 1 and 2:* Northern Irish fisheries anticipate that the reference area will displace their bottom trawlers into fewer and smaller fishing grounds (in between rMCZ 1 and rMCZ 2). They estimate that at least 45 vessels are likely to be affected. These

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th>rMCZ Reference Area A, Mud Hole</th></tr>
<tr><td colspan="2">the home ports of Ardglass, Barrow, Fleetwood, Kilkeel, Maryport, Portavogie and Whitehaven (ISCZ, 2010). Stakeholder meetings have suggested that nearer to 70 vessels bottom trawl in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). VMS data indicate that bottom trawling by over 15 metre UK vessels takes place in the site (MMO, 2011a).
The estimated value of landings from the site is £0.257m/yr (MCZ Fisheries Value Model).</td><td>vessels are mostly associated with Kilkeel but also Portavogie. They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation. For Northern Irish vessels, this may raise questions about the viability of travelling over to the East Irish Sea to fish. Nephrops caught in this site are good quality and are sold 'whole' for a higher price per tonne compared with the nephrop 'tail' market. 'Whole' nephrops obtain a higher price per tonne compared with nephrop 'tails' which are solely for processing into products such as scampi. 'Whole' nephrops are mostly sold abroad as it is popular on the continent to eat them whole. As such, the landings estimate for bottom trawling for this site may not reflect the higher price obtained for whole nephrops compared to tail nephrops. (NIFPO, 2011; ANIFPO, 2011).
Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011; NIFPO, 2011).

Comments from the Cumbrian fishing fleet and the North Western Inshore Fisheries and Conservation Authority (NWIFCA): *Regarding Scenarios 1 and 2:* NWIFCA and representatives of the Cumbrian fishing fleet report that the closure of bottom trawling in this site is likely to affect around 30 Cumbrian vessels' comprising 14 vessels from Whitehaven, 12 vessels from Maryport and fewer than 5 vessels from Barrow and Fleetwood. They feel that, together, the rMCZ and the proposed/operational wind farm developments in the East Irish Sea will 'squeeze' the Cumbrian bottom trawlers into fewer and smaller fishing grounds. Landings to the Cumbrian fleet are anticipated to decrease as a result. Landings from this rMCZ contribute to the nephrops market (whole and tail) and there are likely to be knock-on impacts to three fisheries agents as well as to the export market for nephrop products. (Whitehaven Fishermen's Association & NWIFCA, 2011)
Further detail on impacts to the fisheries sector can be found in the Evidence Base.</td></tr>
<tr><td colspan="2">***Dredges:*** Fewer than 5 UK vessels are known to dredge in the site (ISCZ, 2010). They target scallop from October to January. These vessels are associated with the home port of Kilkeel (ISCZ, 2010). Stakeholder meetings have suggested that very few vessels dredge in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table>
<tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr>
<tr><td>Value of landings affected</td><td>0.004</td><td>0.004</td></tr>
</table>
Stakeholders have not provided a description of impact.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries</th><th>rMCZ Reference Area A, Mud Hole</th></tr>
<tr><td colspan="2">Fishermen's Association & NWIFCA, 2011). VMS data indicate that dredging by over 15 metre UK vessels takes place in the site (MMO, 2011a).
The estimated value of landings from the site is £0.004m/yr (MCZ Fisheries Value Model).</td><td></td></tr>
<tr><td colspan="2">Mid-water trawls: Fewer than 5 UK vessels are known to use mid-water trawls in the site. They target herring and prawns from June to December. These vessels are associated with the home ports of Bangor, Portavogie and Ardglass (ISCZ, 2010). Discussions at stakeholder meetings have suggested that very few vessels use mid-water trawls in the site (ANIFPO, 2011; NIFPO, 2011; Whitehaven Fishermen's Association & NWIFCA, 2011). VMS data indicates that mid-water trawling by over 15 metre UK vessels takes place in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Pots and traps: VMS data indicates that pots and traps are used by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.066m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.066</td><td>0.066</td></tr></table>Stakeholders have not provided a description of impact. Discussions with local fishers and NWIFCA do not identify any potting activity in this site. Therefore, this is likely to be an overestimate of cost.</td></tr>
<tr><td colspan="2">Hooks and lines: Only VMS data indicates that hooks and lines are used by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="3">Total direct impact on UK commercial fisheries</td></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.327</td><td>0.327</td></tr><tr><td>GVA affected</td><td>0.137</td><td>0.137</td></tr></table></td></tr>
</table>

Table 2b. Commercial fisheries	**rMCZ Reference Area A, Mud Hole**
	At least 26 UK vessels (bottom trawlers, dredgers and mid-water trawlers) are likely to be affected (ISCZ, 2010). Stakeholder meetings have suggested that nearer to 70 vessels may be affected (ANIFPO, 2011) (NIFPO, 2011) (Whitehaven Fishermen's Association & NWIFCA, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in site impacted under each scenario. Scenario 1: 26 Scenario 2: 30
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
Part of this site lies between 6nm and12nm in an area where the Irish fleet has historic fishing rights to bottom trawl for nephrops. VMS data indicate the use of bottom trawls by over 15 metre vessels in the site by Irish vessels (MMO, 2011a).	The Irish fishing fleet has not provided a description of impact. Quantitative estimates are not available.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area A Mud Hole**
Recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area A, Mud Hole**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use dredges to target scallops and mid-water trawls to target herring and prawns (ISCZ,	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries and/or	Anticipated direction of change: ⇧ Confidence:

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area A, Mud Hole**
2010). See Table 2 for more detail. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into the pelagic (open water) realm (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).	mid-water trawling. Therefore, there will be no benefits to fisheries from vessel activity in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Moderate

Table 4b. Regulating services		**rMCZ Reference Area A, Mud Hole**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area A, Mud Hole**
Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to the depth of the water column and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crabs, harbour crabs, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	from pressures caused by human activities.	

Table 4c. Research and education		**rMCZ Reference Area A, Mud Hole**
Baseline	**Beneficial impact**	
The extent of current research activity carried out in the site is unknown. However, Lumb and others (2011, in ISCZ, 2011) and Hughes & Atkinson (1997, in ISCZ, 2011) have studied sea-pens and burrowing animals within this part of the Irish Sea. Clements (2010) has studied the deep water mud habitats in and around the site.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human	Anticipated direction of change: ⇧

Table 4c. Research and education		**rMCZ Reference Area A, Mud Hole**
	activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Confidence: High

Table 4d. Non-use and option values		**rMCZ Reference Area A, Mud Hole**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), one 'nominated site' falls within the boundary of rMCZ 1. The one stakeholder (a recreational fisher) nominated the site because they perceived the area to be under threat. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H).	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area B North St George's Channel (1) Site area (km^2): 35.28

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts	**rMCZ Reference Area B, North St George's Channel (1)**

1a. Ecological description

Recommended MCZ Reference Area B is located in the north-eastern part of rMCZ 3. It comprises both high and moderate energy circalittoral rock, or bedrock, on the sea floor which is subject to a high to moderate level of wave and tidal energy. Parts of these areas of bedrock have been surveyed to verify the presence of specific Annex I reef habitat, listed in the EC Habitats and Species Directive. Recommended MCZ Reference Area B is part of the wider north-west Anglesey reef complex. Such rocky reefs occur where the bedrock or stable boulders and cobbles protrude from the surrounding sea bed, creating a habitat that is colonised by many different marine animals and plants. Rocky reefs can be variable in terms of both their structure and the communities that they support (Irving (2009) in ISCZ, 2011).

The boulders and cobbles in Recommended MCZ Reference Area B are home to a variety of animal species such as the opportunistic tube worm *Pomatoceros triquete* that encrusts onto hard substrates such as rock; the soft coral, dead man's fingers *Alcyonium digitatum*, which attaches where otherwise dominant algae are unable to grow – they are also closely associated with prevailing strong water movement. Hornwrack *Flustra foliacea* along with hydroids such as *Abietinaria abietin* were also identified on such wave-exposed circalittoral rock habitats. Underwater video has shown that the reef habitat tends to alternate with more gravelly areas of non-reef habitat (Blyth-Skyrme and others (2008) in ISCZ, 2011).

In this area, sands and gravels are mainly shell derived (Maddock (2010) in ISCZ, 2011) and support an abundance of bivalves and polychaete worms. Bolam and others (2010, in ISCZ, 2011) identified molluscs and annelid worms which live within the sediment as the main secondary producers in this part of the Irish Sea. These animals are a key part of the food chain, as they recycle organic matter from within the sediment, linking primary production from the plankton to predatory fish. They are able to unlock the energy of primary producers, which in the sea are the phytoplankton (microscopic algae), and make it available to be used as food by other creatures. As such, primary producers are the very basis of the food chain that provides the fish consumed by humans (Bolam and others (2010) in ISCZ, 2011).

Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. St George's Channel is a key part of their migratory route, utilising the nutrient-rich waters formed by tidal mixing currents (Stephan and others (2011) in ISCZ, 2011). Recommended MCZ Reference Area 3 is an important area for foraging sea birds that breed in Welsh (often Special Protection Area (SPA)) colonies. Gannet, Manx shearwater, fulmar, guillemot and puffin are sea bird species that are highly likely to forage at this location. The northern section of the site contains an important pelagic front, which is heavily used by a number of species. Locally, guillemots *Uria aalge* feed on sand eels, herrings and sprats; puffins *Fratercula arctica* feed on sand eels and capelins; gannets *Morus bassanus* feed on mackerel, herrings and sand eels; Manx shearwaters *Puffinus puffinus* feed on herrings, sprats, whitebait and pilchards (RSPB, pers comm., 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock and Connor, 2000). Source: ISCZ (2011).Source: ISCZ (2011)

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ

Broad-scale Habitats				
High Energy Circalittoral Rock	8.63	-	Unfavourable condition	Recover to reference condition
Moderate Energy Circalittoral Rock	22.73	-	Unfavourable condition	Recover to reference condition
Subtidal Coarse Sediment	3.93	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Subtidal Sands and Gravels	35.27	1	Unfavourable condition	Recover to reference condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries — **rMCZ Reference Area B, North St George's Channel (1)**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries apart from mid-water trawling.

Management scenario 2: Closure of entire rMCZ to all commercial fisheries.

Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit . A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), at least seven vessels are known to fish in this site (both under and over 15 metre vessels) (ISCZ, 2010). They use bottom trawls, mid-water trawls, pots and traps, hooks and lines. They are mainly associated with Northern Irish, Scottish and Welsh ports and target nephrops, scallops, whelks, whitefish, herring, spurdog, skates and rays, catfish and dogfish. Vessel Monitoring System (VMS) data indicates the use of hooks and lines and pots and traps by over 15 metre UK vessels in the site (MMO, 2011a). There is no evidence of dredges and nets being used in the site. The estimated total value of UK landings from the site is <£0.001m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: Fewer than 5 UK vessels are known to use bottom trawls (including seine nets) in the site throughout the year. These are Scottish and Northern Irish vessels targeting scallops (ISCZ, 2010). These vessels are associated with the home ports of Ardglass and Kirkcudbright. Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data provides no evidence of fishing by over 15 metre vessels in the site (MMO, 2011a). The estimated value of landings from the site is <£0.001m/yr.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 Value of landings affected | <0.001 | <0.001 Stakeholders have not provided a description of impact.
Mid-water trawls: Fewer than 5 UK mid-water trawlers are known to fish in the site, targeting herring, whitefish, scallops and nephrops from April through to December (ISCZ, 2010). These are Welsh and Northern Irish vessels associated with the home ports of Ardglass, Bangor, Portavogie and Kilkeel. Stakeholder	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 Value of landings affected | <0.001 | <0.001 Stakeholders have not provided a description of impact.

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th colspan="2">rMCZ Reference Area B, North St George's Channel (1)</th></tr>
<tr><td colspan="2">meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data provides no evidence of fishing by over 15 metre vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2"></td></tr>
<tr><td colspan="2">Pots and traps: Fewer than 5 UK potters are known to fish in the site. They target whelks throughout the year and are Welsh vessels associated with the home ports of Holyhead (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data indicates the use of pots and traps by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Hooks and lines: Fewer than 5 UK vessels are known to fish in the site. These are Welsh vessels targeting catfish, dogfish, spurdog, skates and rays throughout the year (ISCZ, 2010). These vessels are associated with the home port of Holyhead. Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data indicates the use of hooks and lines by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="4">Total direct impact on UK commercial fisheries</td></tr>
<tr><td colspan="2"></td><td colspan="2">The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr><tr><td>GVA affected</td><td><0.001</td><td><0.001</td></tr></table>Fewer than five UK vessels are likely to be affected (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number of vessels is low (Stakeholder Focus Meeting, 2011).
The estimated value of landings impacted from the site is <£0.001m/yr.
Estimated minimum number of UK vessels impacted (ISCZ, 2010):
Scenario 1: < 5
Scenario 2: 7</td></tr>
<tr><td colspan="2">Baseline description of non-UK fisheries</td><td colspan="2">Costs of impact of rMCZ on non-UK commercial fisheries</td></tr>
<tr><td colspan="2">There is no evidence of non-UK vessels working this site (MMO, 2011a).</td><td colspan="2">None.</td></tr>
</table>

Table 2b. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ Reference Area B, North St George's Channel (1)**
Oil and gas related activities (including carbon capture and storage)	
It is unlikely that any oil and gas (including carbon capture and storage) infrastructure will be proposed in future in this rMCZ Reference Area due to the location and size of the rMCZ reference area (DECC, pers. comm., 2012)	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area B, North St George's Channel (1)**
Recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area B, North St George's Channel (1)**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Fishing vessels are known to use bottom trawls, mid-water trawls, pots and traps, and hooks and lines in the site. See Table 2 for more detail. Subtidal gravel and sand sediments are important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site (that provide this service) when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services	**rMCZ Reference Area B, North St George's Channel (1)**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4c. Research and education	**rMCZ Reference Area B, North St George's Channel (1)**	
Baseline	**Beneficial impact**	
Research: Numerous surveys have been undertaken in the site associated with the proposed Round 3 (Zone 9) wind farm area of	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of	Anticipated direction of

Table 4c. Research and education	**rMCZ Reference Area B, North St George's Channel (1)**	
search and various cable developments. This comprises benthic surveys, fisheries surveys, acoustic surveys etc. Rees (2005, in ISCZ, 2011) has studied the horse mussel beds in this part of the Irish Sea. The Joint Nature Conservation Committee (JNCC) (2011, in ISCZ, 2011) has researched the Croker Carbonate Slabs in the site which are a recommended Special Area of Conservation (SAC).	prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area B, North St George's Channel (1)**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area C, Mid St George's Channel Site area (km^2): 103.46

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts	**rMCZ Reference Area C, Mid St George's Channel**
1a. Ecological description	
This site is located within the southwest portion of rMCZ 4 in the offshore waters of the Irish Sea, c.40km from the coast of Wales. The depth of the site ranges from 50 metres to100 metres. The sea bed type is predominantly subtidal coarse sediment, but there are also areas of subtidal mixed sediments, sand and bedrock, which is potentially reef habitat (Dalkin (2008) in ISCZ, 2011). Due to the thermal fronts that form in the summer months, this is an area of relatively high biological productivity (Miller and others (2010) in ISCZ, 2011). This indicates the importance of this site for general ecosystem processes, as an increase in primary production attracts herbivorous species and, in turn, larger marine predators to the area. Within the subtidal sands and gravel habitat in this area, annelid worms, bivalves and crustaceans are the main secondary producers. These animals provide an essential link in energy flow within the ecosystem, recycling organic matter in the sediment, linking primary production to predatory fish (Bolam and others (2010) in ISCZ, 2011). The subtidal bedrock, namely cobbles and boulders, is of ecological importance because it supports a diverse animal community. Barnacles and worms, including *Pomatoceros triqueter*, were found within the offshore circalittloral coarse sediment, while the subtidal mixed sediments contained pebbles, cobbles and boulders that were home to a diverse range of fauna, including barnacles, hydroids, anemones and sponges, for example, dead man's fingers *Alcyonium digitatum* (Dalkin and others (2008) in ISCZ, 2011). Sand and gravel sediments host a range of different invertebrate species; annelids, worms and crustacean species are the main secondary producers in the food web (Bolam and others (2010) in ISCZ, 2011). These species, which live within or on the sea bed, play a key role in recycling organic matter within the sediment and link the primary production (in the plankton) with predatory fish. In addition, this site covers an area of high primary productivity, due to the thermal fronts which commonly form in this location (Miller and others (2010) in ISCZ, 2011). An increase in solar energy during spring causes the relatively warm, less dense, water to sit on top of colder, denser, deep water. This increase in temperature triggers an increase in biological productivity, similar to the increase in productivity later on in the year when water cooling allows for nutrient-rich deeper waters coming in from the Atlantic to mix with the surface waters (Brown and others (2010) in ISCZ, 2011). This indicates the importance of this site for general ecosystem processes, as an increase in primary production attracts herbivorous species and, in turn, larger marine predators to the area. Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. St George's Channel is a key part of their migratory route, utilising the nutrient-rich waters formed by tidal mixing currents (Stephan and others (2011) in ISCZ, 2011). The site is an important area for sea birds in the Irish Sea providing a foraging ground to a wide range of species including guillemots *Uria aalge*, gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus* and puffins *Fratercula arctica*. These birds can have significant foraging radii (the gannet can travel up to 300km) and will from Welsh and Irish colonies, in particular Cardigan Bay and the rocky cliffs on the east coast of Ireland (RSPB, pers comm., 2011). The large numbers of sand eel *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).	

1b. MCZ Feature Baseline and Impact of MCZ				
Feature	**Area of feature (km^2)**	**No. of point records**	**Baseline**	**Impact of MCZ**
Broad-scale Habitats				
Moderate Energy Circalittoral Rock	21.16	-	Unfavourable condition	Recover to reference condition
Subtidal Coarse Sediment	34.80	-	Unfavourable condition	Recover to reference condition
Subtidal Mixed Sediment	46.45	-	Unfavourable condition	Recover to reference condition
Subtidal Sands	1.04	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Subtidal Sands and Gravels	103.43	2	Unfavourable condition	Recover to reference condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries	**rMCZ Reference Area C, Mid St George's Channel**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of entire rMCZ to all commercial fisheries apart from mid-water trawling. ***Management scenario 2***: Closure of entire rMCZ to all commercial fisheries.	
Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit . A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), fewer than 5 vessels are known to fish in the site (both under and over 15 metre vessels). These vessels use dredges, drift lines and gill nets and target scallop, spurdog, thornback ray, dogfish and pollack (ISCZ, 2010). Relatively speaking, very little UK fishing activity is known to take place there. Stakeholder meetings gave no indication of how many vessels are active in the site and suggested that the number of vessels is low (Stakeholder Focus Meeting, 2011). Vessel Monitoring System (VMS) data indicates that hooks and lines and mid-water trawls are used by over 15 metre UK vessels in the site but that effort is minimal (MMO, 2011a). A Welsh scallop fisher reported that up to 10 vessels may dredge in the site, but that this is not a principal ground for them (Stakeholder Focus Meeting, 2011). There is no evidence of bottom trawls and pots and traps being used in the site. The estimated total value of UK landings from the site is <£0.001m/yr. This is provided for each affected gear type below.	
Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Dredges: Fewer than 5 vessels are known to use dredges in this site. They target scallop from November to June. They are Scottish vessels (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). There may be approximately ten	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 | Scenario 2 Value of landings affected | <0.001 | <0.001 Stakeholders have not provided a description of impact.

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th>rMCZ Reference Area C, Mid St George's Channel</th></tr>
<tr><td colspan="2">Welsh dredgers that visit the site, but this is not a principal ground for them (Stakeholder Focus Meeting, 2011). There is no evidence from VMS data that vessels over 15 metres fish in this site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td></td></tr>
<tr><td colspan="2">Mid-water trawls: Interviews with fishers did not identify any mid-water trawlers working this area (ISCZ, 2010). However, VMS data indicate that mid-water trawling by over 15 metre UK vessels takes place in the site (MMO, 2011a). No information is available relating to what species the vessels target, at what times of year or what home ports they are associated with. Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Hooks and lines: Fewer than 5 vessels are known to fish in this site. They are Welsh vessels, using long lines to target spurdog, catfish, dogfish and thornback ray throughout the year (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data indicates that hooks and lines are used by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Nets: Fewer than 5 vessels are known to use nets in the site. They use gill nets to target pollack (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data do not identify any activity by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><th colspan="3">Total direct impact on UK commercial fisheries</th></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr><tr><td>GVA affected</td><td><0.001</td><td><0.001</td></tr></table>Fewer than 5 vessels are known to fish in the site, and so are likely to be affected. They use long</td></tr>
</table>

Table 2a. Commercial fisheries	**rMCZ Reference Area C, Mid St George's Channel**
	lines, gill nets and dredges (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario: Scenario 1: < 5 Scenario 2: < 5
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
VMS data indicate that Irish dredgers (over 15 metre non-UK vessels) are active in the site but it does not appear to be their main grounds. There is no other evidence of non-UK vessel activity in the site (MMO, 2011a).	The Irish fleet has not provided a description of impact. Quantitative estimates are not available.

Table 2b. National defence	**rMCZ Reference Area C, Mid St George's Channel**
Source of costs of the rMCZ ***Management scenario 1:*** Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use off the whole site as a firing range.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ Reference Area C, Mid St George's Channel**
Oil and gas related activities (including carbon capture and storage) It is unlikely that any oil and gas (including carbon capture and storage) infrastructure will be proposed in future in this rMCZ Reference Area due to the location and size of the rMCZ reference area (DECC, pers. comm., 2012)	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area C, Mid St George's Channel**
Recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area C Mid St George's Channel**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).Very little fishing is known to take place in the site. However, there is some evidence of UK vessels using dredges, hooks and lines, nets and mid-water trawls. See Table 2 for more detail. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services	**rMCZ Reference Area C, Mid St George's Channel**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is	Anticipated direction of

Table 4b. Regulating services	**rMCZ Reference Area C, Mid St George's Channel**	
occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	change: ⇧ Confidence: Moderate

Table 4c. Research and education	**rMCZ Reference Area C, Mid St George's Channel**	
Baseline	**Beneficial impact**	
The level of research undertaken in the site is unknown.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are	Anticipated direction of change: ⇧

Table 4c. Research and education	**rMCZ Reference Area C, Mid St George's Channel**	
	unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area C, Mid St George's Channel**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area F, South Rigg — Site area (km^2): 15.82

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area F, South Rigg**

1a. Ecological description

Recommended MCZ Reference Area F is located in rMCZ 6, which is in the western Irish Sea between three different territorial seas – northern Irish waters to the west, Scottish waters to the north and the Isle of Man waters to the east. The depth of the sea bed in the site ranges from 50 metres to 150 metres. The site is largely comprised of subtidal sand. The infaunal community of species present is relatively diverse and ranges from echinoderms such as sea potato *Echinocardium cordatum*, brittlestar *Amphiura filiformis,* shrimp-like crustaceans *Mysidea* spp. and bivalves. There is also a large annelid worm population (Agri-Food and Biosciences Institute (AFBI), unpublished data; Service, pers. comm., 2011). Bolam and others (2010, in ISCZ, 2011) identified molluscs (bivalves) and annelid worms which live within the sediment as the main secondary producers in this part of the Irish Sea. These animals are a key part of the food chain; they recycle organic matter from within the sediment, linking primary production from the plankton to predatory fish (Bolam and others (2010) in ISCZ, 2011). Within Recommended MCZ Reference Area F, herring *Clupea harengus*, whiting *Merlangius merlangus* and spurdog *Squalus acanthias* were found in high intensity in both spawning and nursery grounds.A small portion of subtidal sand within the site supports possibly the only breeding population of the ocean quahog *Arctica islandica* in the Irish Sea (Butler (2009) in ISCZ, 2011). The ocean quahog is a long-lived bivalve which, like trees, deposits an annual growth ring, the width of which can be used as a proxy for environmental conditions. Its shell material is an important palaeoclimatic tool that can be used to study the history of changes in sea temperature and other marine environmental variables on multi-centennial timescales (Butler (2009) in ISCZ, 2011).

The deep water, low energy conditions in this site lead to a seasonal cyclonic gyre (i.e. a vortex or rotating body of water) during the summer and spring months, which physically contain *Nephrops* and pelagic juvenile fish larvae within the western Irish Sea (Horsburgh and others (2000) in ISCZ, 2011). The site also contains a productive pelagic front which is heavily used by a number of species. It is an important foraging area for sea birds in the Irish Sea, including guillemots *Uria aalge*, gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus*, razorbills *Alca torda* and puffins *Fratercula arctica*. The birds probably originate from Manx (Isle of Man) and Irish colonies (RSPB, pers comm., 2011). Guillemots *Uria aalge* feed on sandeel, herring and sprat; puffins *Fratercula arctica* feed on sandeel and capelin; gannets *Morus bassanus* feed on mackerel, herring and sandeel; Manx shearwaters *Puffinus puffinus* feed on herring, sprat, whitebait and pilchards; razorbill *Alca torda* feed on sandeel, herring and sprat (RSPB, pers. comm., 2011). The large numbers of sandeel *Ammodytes* spp. present in sandy sediment attract sea birds such as puffin, razorbill, guillemot and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Subtidal Mud	0.37	-	Unfavourable condition	Recover to reference condition
Subtidal Sand	15.44	-	Unfavourable condition	Recover to reference condition
Species of Conservation Importance				

Ocean Quahog	-	56	Unfavourable condition	Recover to reference condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries **rMCZ Reference Area F, South Rigg**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries.

Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit . A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), around 95 UK vessels are thought to fish in this site (both under and over 15 metre vessels) (ANIFPO, 2011; NIFPO, 2011). At least 37 vessels are known to fish in the site (ISCZ, 2010). The site is part of the largest nephrops fishing ground (in terms of area) in the ISCZ Project Area, and as such is very important in terms of landings to the Northern Irish fleet (ISCZ, 2010), in particular to vessels from the ports of Kilkeel and Portavogie (NIFPO, pers. comm., 2011). While it is mainly bottom trawls (twin and single-rig otter trawls) used in the site, mid-water trawls and dredges are also used (ISCZ, 2010). Vessel Monitoring System (VMS) data indicate the use of hooks and lines in the site (MMO, 2011a). There is no evidence of nets or pots and traps being used in the site. The estimated total value of UK landings from the site is £0.164m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: Up to 95 UK vessels are thought to use bottom trawls (twin and single-rig otter trawls and pair trawls) in the site (ANIFPO, 2011; NIFPO, 2011). At least 29 UK vessels are known to use bottom trawls in the site (ISCZ, 2010). They target primarily nephrops throughout the year but also shrimp, cod, haddock, pollack, whitefish and scallop. These vessels are associated with the home ports of Kilkeel, Ardglass and Portavogie. VMS data indicates a high degree of bottom trawling effort by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £0.111m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 Value of landings affected | 0.111 ***Comments from representatives of the Northern Ireland fishing fleet:*** *Regarding Scenario 1:* Northern Irish fisheries anticipate that rMCZ Reference Area F will displace their bottom trawlers into fewer and smaller fishing grounds (south of rMCZ 7). They estimate that at least 45 vessels are likely to be affected. These vessels are mostly associated with Kilkeel but also with Portavogie. They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation. This site is important as good quality nephrops for the 'whole' market are fished from the site. Whole nephrops obtain a higher price per tonne compared to nephrops 'tails' which are sole for processing into products such as scampi. Whole nephrops are mostly sold abroad as it is popular on the continent to eat them whole. As such, the landings estimate for bottom trawling for this site is likely to be an under-estimate as it is based on an average of tail/whole nephrop price per tonne which is used in the MCZ Fisheries Model. Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ Reference Area F, South Rigg</th></tr>
<tr><td></td><td>be affected first as they have greater overheads (due to higher borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This means that the processing sector is likely to lose its best suppliers first. (ANIFPO, 2011; NIFPO, 2011).
Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports, and the ports are largely dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011; NIFPO, 2011).
Further detail on impacts to the fisheries sector can be found in Annex J and Annex F.</td></tr>
<tr><td>Dredges: Fewer than 5 UK vessels are known to dredge (towed and suction gear) in the site for scallop from November to June. These vessels are associated with the home ports of Kilkeel and Kirkcudbright (ISCZ, 2010). VMS data indicates that dredging by over 15 metre UK vessels takes place in the site, but that effort is low.
The estimated value of landings from the site is £0.008m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.008</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Mid-water trawls: Six mid-water trawlers are known to fish in the site (ISCZ, 2010). They target herring, prawn and whitefish throughout the year. These vessels are associated with the home ports of Portavogie, Ardglass and Bangor (Northern Ireland). VMS data indicates that mid-water trawling by over 15 metre UK vessels takes place in the site but that these are not the principal fishing grounds in the Irish Sea Project Area (MMO, 2011a).
The estimated value of landings from the site is £0.045m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.045</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Hooks and lines: VMS data provide the only evidence of the use of hooks and lines by over 15 metre UK vessels in the site. Stakeholder meetings did not indicate the use of hooks and lines in the site.
The estimated total value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th>rMCZ Reference Area F, South Rigg</th></tr>
<tr><th colspan="3">Total direct impact on UK commercial fisheries</th></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.164</td></tr><tr><td>GVA affected</td><td>0.073</td></tr></table>Up to 95 UK vessels are thought to use bottom trawls (twin and single-rig otter trawls and pair trawls) in the site (ANIFPO, 2011; NIFPO, 2011). Some 37 UK vessels (bottom trawlers, dredgers and mid-water trawlers) have indicated that they fish in the site (ISCZ, 2010). VMS data indicate the use of hooks and lines in the site (MMO, 2011a). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:
Scenario 1: 37–95</td></tr>
<tr><th colspan="2">Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td colspan="2">There may be some Irish vessels fishing in the site although VMS data indicate that fishing effort by over 15 metre non-UK vessels is very low in the site. Stakeholder engagement has not identified any non-UK vessel activity.</td><td>The Irish fleet has not provided a description of impact. Quantitative estimates of impact are not available.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2b. National defence</th><th>rMCZ Reference Area F, South Rigg</th></tr>
<tr><td colspan="3">Source of costs of the rMCZ
Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.</td></tr>
<tr><th colspan="2">Baseline description of activity</th><th>Costs of impact of rMCZ on the sector</th></tr>
<tr><td colspan="2">The Ministry of Defence is known to make use of the whole site as a submarine exercise area.</td><td>It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.</td></tr>
</table>

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ Reference Area F, South Rigg**
Oil and gas related activities (including carbon capture and storage) It is unlikely that any oil and gas (including carbon capture and storage) infrastructure will be proposed in future in this rMCZ Reference Area due to the location and size of the rMCZ reference area (DECC, pers. comm., 2012)	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area F, South Rigg**
Recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area F, South Rigg**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use mid-water trawls. See Table 2 for more detail. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into the pelagic (open water) realm (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ 2nd	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area F, South Rigg**
Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). *Arctica islandica* has a range of predators including haddock, ocean pout and various crustaceans (Hill (2010) in Fletcher and others (2012)). It is an important food source for cod (*Gadus morhua*) (Sabatini (2008) in Fletcher and others (2012)). *Arctica islandica* has also been found in the stomach of North Sea cod (Rees (1993) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in ISCZ, 2011).	iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	

Table 4b. Regulating services		**rMCZ Reference Area F, South Rigg**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area F, South Rigg**
others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)).Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to the depth of the water column and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crab, harbour crab, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership, 2010) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education	**rMCZ Reference Area F, South Rigg**	
Baseline	**Beneficial impact**	
Research: The Northern Ireland AFBI has undertaken various research in the site. This has included mapping of *Nephrops* burrow density. Ocean quahogs have previously been studied (some in the site) to understand ocean conditions and climatic variability (Butler (2009) in ISCZ, 2011). Ocean quahogs are also indicators of heavy metal accumulation in pollutant biomonitoring research (Liehr (2005) in Fletcher and others (2012)) and so the site provides significant research potential due to the limited distribution of ocean quahogs in the Irish Sea.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area F, South Rigg**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area G, Slieve Na Griddle

Site area (km^2): 4.46

Site-specific benefits arising from the MCZ (over 2013 to 2032)

Table 1. Conservation impacts — **rMCZ Reference Area G, Slieve Na Griddle**

1a. Ecological description

This site is located in rMCZ 7 in the western Irish Sea. Mud habitat and bedrock make up the sea bed in the site and the depth ranges from 100 metres to 150 metres. The Pisces Reef complex (comprised of low energy circalittoral rock) falls partly within the boundary of the site which qualifies as Annex 1 reef habitat according to the EC Habitats and Species Directive and has been formally recommended as a Special Area of Conservation (SAC). The Pisces Reef is comprised of three bedrock pinnacles which rise 15–35 metres from the sea floor. The reef supports a diverse animal community, including hydroids (e.g *Diphasia nugra*), a range of sponges, including the cup sponge *Axinella infundibuliformi*, echinoderms, for example the cushion starfish *Porania pulvillus*, and various crustaceans, for example the edible crab *Cancer pagurus* and squat lobster *Munida rugosa*. Additionally, the reef may provide shelter for juvenile fish, including blue whiting, bib, red gurnard and wrasse (Judd (2004) in ISCZ, 2011).

The low energy mud habitat in this region (Horsburgh and others (2000) in ISCZ, 2011) supports a thriving and commercially important Dublin Bay prawn *Nephrops norvegicus* fishery. The *Nephrops* fishery is particularly important since the collapse and decline of cod and whiting fisheries in the region and, based on fishery independent video survey data (between 2003 and2007), it appears that *Nephrops* burrows are decreasing in density (Clements (2010) in ISCZ, 2011). Close to the Pisces Reef, the soft sediment in which the *Nephrops* burrow is inaccessible to traditional fishing methods and, as such, the reef provides a natural refuge from fishing pressure. During submersible trials in the 1970s, scattered sea-pens were recorded in the soft sediments between rocky outcrops of the Pisces Reef, but they are no longer present in the same abundance (JNCC (2011) in ISCZ, 2011).

Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. It was found that the area is used significantly by basking sharks during the months of July to September utilising the nutrient-rich stratified waters between the Isle of Man and Northern Ireland (Stephan and others (2011) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Low Energy Circalittoral Rock	2.04	-	Unfavourable condition	Recover to reference condition
Subtidal Mud	2.41	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Deep Water Mud Habitats	4.46	1	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries — **rMCZ Reference Area G, Slieve Na Griddle**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries apart from mid-water trawling.

Management scenario 2: Closure of entire rMCZ to all commercial fisheries.

Summary of all UK commercial fisheries: The site lies completely outside the 12 nautical mile (nm) limit. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), around 40 UK vessels are thought to fish in this site (both under and over 15 metre vessels) (ANIFPO, 2011; NIFPO, 2011). At least 37 vessels are known to fish there (ISCZ, 2010). These vessels use mainly bottom trawls (twin and single-rig otter trawls) in the site, but mid-water trawls are also used. The site is part of the most intensely fished part of the ISCZ Project Area by effort and landings value (MMO, 2011a). The site is part of the largest nephrops fishing ground (in terms of area) in the ISCZ Project Area, and as such is very important in terms of landings to the Northern Irish fleet (ISCZ, 2010), in particular to vessels from the port of Ardglass (NIFPO, pers. comm., 2011). Vessel Monitoring System (VMS) data indicate the use of bottom trawls, hooks and lines and mid-water trawls. There is no evidence of other pots and traps, dredges and nets being used in the site. The estimated total value of UK landings from the site is £0.052m/yr) (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries

Bottom trawls: Approximately 40 UK vessels are thought to use bottom trawls (twin and single-rig otter trawls and pair trawls) in the site (ANIFPO, 2011; NIFPO, 2011). At least 31 UK vessels are known to use bottom trawls in the site (ISCZ, 2010). They target primarily nephrops throughout the year but also shrimp, cod, haddock, pollack and whitefish. These vessels are associated with the home ports of Kilkeel, Ardglass and Portavogie. VMS data indicates a high degree of bottom trawl effort by over 15 metre UK vessels in the site (MMO, 2011a).

The estimated value of landings from the site is £0.050m/yr (MCZ Fisheries Value Model).

Costs of impact of rMCZ on UK commercial fisheries

The annual value of UK landings affected is estimated to fall within the following range:

£m/yr	Scenario 1	Scenario 2
Value of landings affected	0.050	0.050

Comments from representatives of the Northern Ireland fishing fleet: *Regarding Scenarios 1 and 2:* Northern Irish fisheries anticipate that the site will displace their bottom trawlers into fewer and smaller fishing grounds (south of rMCZ 7). They estimate that at least 30 to 40 vessels are likely to be affected. These vessels are mostly associated with Ardglass. They feel that the area of nephrops fishing grounds lost would be greater than the area of the rMCZ itself as the grounds adjacent to the rMCZ are likely to become impractical to trawl because of the MCZ designation.

Northern Irish fisheries are concerned that these impacts, combined with the anticipated impacts of other industry proposals and legislation, cumulatively provide no other options for many of their vessels. Many vessels are likely to be forced to leave the industry. Northern Irish fisheries state that the larger, newer and more powerful boats are likely to be affected first as they have greater overheads (due to larger borrowing costs) and are more vulnerable to increased fuel costs (if they have to travel further to fishing grounds). This will mean that the processing sector will lose its best suppliers first.

Northern Irish fisheries have concerns about the knock-on impacts to the processing sector, jobs, supply and service industries and the community. There are few other employment options in the Northern Ireland's fishery ports and the ports are dependent on fisheries-related employment (outside agriculture and manufacturing). (ANIFPO, 2011; NIFPO, 2011)

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ Reference Area G, Slieve Na Griddle</th></tr>
<tr><td></td><td>Further detail on impacts to the fisheries sector can be found in Annex J and Annex F.</td></tr>
<tr><td>Dredges: There is no evidence for dredging in this site.
The estimated value of landings from the site is £0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.001</td><td>0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Pots and traps: There is no evidence of the use of pots and traps in this site. The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Mid-water trawls: At least seven UK vessels are known to use mid-water trawls in the site (ISCZ, 2010). They target herring, whitefish and nephrops. These vessels are associated with the home ports of Kilkeel, Ardglass, Portavogie and Bangor (Northern Ireland). VMS data indicates the use of mid-water trawls by over 15 metre UK vessels in the site but that effort is minimal (MMO, 2011a). The estimated value of landings from the site is £0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.000</td><td>0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td>Hooks and lines: There is no evidence for the use of hooks and lines in this site. The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.051</td><td>0.052</td></tr><tr><td>GVA affected</td><td>0.021</td><td>0.021</td></tr></table>Approximately 40 UK bottom trawlers are anticipated to be affected (ANIFPO, 2011; NIFPO, 2011). At least 37 UK vessels (bottom trawlers and mid-water trawlers) are known to fish in the site and so will be affected (ISCZ, 2010).
Estimated minimum number of UK vessels impacted (ISCZ, 2010):
Scenario 1: 31–40
Scenario 2: 37–40</td></tr>
<tr><th>Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td>VMS data does not indicate any fishing activity for over 15 metre non-UK</td><td>None.</td></tr>
</table>

Table 2a. Commercial fisheries	**rMCZ Reference Area G, Slieve Na Griddle**
vessels in the site. Neither do discussions with stakeholders.	

Table 2b. National defence	**rMCZ Reference Area G, Slieve Na Griddle**
Source of costs of the rMCZ	
Management scenario 1: Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of the whole site as a submarine exercise area.	It is not known whether this rMCZ will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ Reference Area G, Slieve Na Griddle**
Oil and gas related activities (including carbon capture and storage)	
It is unlikely that any oil and gas (including carbon capture and storage) infrastructure will be proposed in future in this rMCZ Reference Area due to the location and size of the rMCZ reference area (DECC, pers. comm., 2012)	

Human activities in the site that are not negatively affected by the rMCZ (over 2012 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area G, Slieve Na Griddle**
Recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area G, Slieve Na Griddle**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).The rMCZ is located on the edge of one of the two major *Nephrops* fishing grounds in the Irish Sea Conservation Zones Project Area (MMO, 2011a). Vessels currently use primarily bottom trawls (mainly otter trawls) in the rMCZ to target *Nephrops* (mainly March to October) but they also use mid-water trawls and hooks and lines to target a number of species. More detail is provided in Table 2. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into pelagic (open water) layers (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. It may be assumed that the condition of the features in the site is less than favourable as the sea-pens and burrowing animals (found in subtidal mud and deep water habitats) are known to be vulnerable to otter trawl impacts (Hinz and others (2009) in Fletcher and others (2012).	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. The Stakeholder Advisory Panel (SAP) (SAP final response to ISCZ, 2nd iteration) identified that 'the provision of a pMCZ in the mud areas, while potentially removing ground from access to the fishing industry, will yield long-term benefits. In both areas, the occurrence of gyres in the summer months entrains the larvae of *Nephrops* such that they recruit back onto the same fishing ground. Protection of an element of the mud patches in both areas should increase the reproductive output and recruitment into the remaining fishing grounds. Such protection would also guard against sex biased mortality, which can occur at present.' Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services	**rMCZ Reference Area G, Slieve Na Griddle**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also promotes the return of mineralised nutrients to the overlying seawater at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Due to the depth of the water column and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)).. Fauna associated with these habitats include seapens and burrowing crustaceans, starfish, hermit crab, harbour crab, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area G, Slieve Na Griddle**
areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**rMCZ Reference Area G, Slieve Na Griddle**
Baseline	**Beneficial impact**	
Research: The Northern Ireland Agri-Food and Biosciences Institute has undertaken various research in this area of the Irish Sea. This has included mapping of *Nephrops* burrow density. The Joint Nature Conservation Committee (JNCC) (2011, in ISCZ, 2011) has researched the Pisces Reef in the site, which is a recommended SAC.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ Reference Area G, Slieve Na Griddle**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area H, Allonby Bay

Site area (km^2): 4.91

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area H, Allonby Bay**

1a. Ecological description

This site is situated on the north Cumbrian coast within Allonby Bay and is located within rMCZ 10. The site lies 0.9km offshore and has a depth range of <10 metres.

Maryport Roads, an area of subtidal coarse sediment that partly falls within this site, was surveyed extensively between the late 1960s and 1980s and has been noted as an area of high biodiversity (e.g. Perkins (1973, 1988) in ISCZ, 2011). It was identified to have an extremely diverse, shallow and cobbley area associated with subtidal mixed sediments. It is extremely productive and diverse with sponges, soft corals such as dead man's fingers *Alyconium digitatum*, bryozoans including hornwrack *Flustra foliacea*, the red sea squirt *Dendrodoa grossularia*, anemones, hydroids and the reef-building honeycomb worm *Sabellaria alveolata* (English Nature (1997) in ISCZ, 2011). Subtidal sand sediments at Maryport Roads are characterised by the bivalves *Mactra stultorum* and banded wedge shell *Donax vittatus*, medium sands by the bivalve surf clam *Spisula solida*, and muddy sands by the polychaete *Nephtys* spp. and the bivalves *Nucula sulcata*, *Abra albida* and *Angulus tenuis* (Perkins (1973, cited in Mills, 1998) in ISCZ, 2011).This area has also been identified by the Regional Stakeholder Group as an important spawning ground for commercial species including skate, thornback ray *Raja clavata* and bass. It is also thought to be an important pupping ground for harbour porpoise *Phocoena phocoena*.

The site is part of an important area for sea birds in the Irish Sea, providing a foraging ground for a wide range of species. These include: guillemots *Uria aalge*, gannets *Morus bassanus*, Manx shearwaters *Puffinus puffinus*, razorbills *Alca torda* and puffins *Fratercula arctica*. Several of these birds are coastal species; they do not forage great distances and originate from English and Scottish colonies (RSPB, pers comm., 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock. & Connor, 2000). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Moderate Energy Infralittoral Rock	0.04	-	Unfavourable condition	Recover to reference condition
Subtidal Coarse Sediment	4.80	-	Unfavourable condition	Recover to reference condition
Subtidal Sand	0.06	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Subtidal Sands and Gravels	4.90	29	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries — **rMCZ Reference Area H, Allonby Bay**

Source of costs of the recommended Marine Conservation Zone (rMCZ)

Management scenario 1: Closure of entire rMCZ to all commercial fisheries. This includes the hand collection of intertidal flora and fauna.

Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), at least five UK vessels have indicated that they are active in the site using bottom trawls, nets, dredges, and pots and traps (ISCZ, 2010). All are under 15 metres in length and target crab, lobster, plaice, skate and ray, brown shrimp and salmon. These vessels are associated with the home ports of Maryport, New Brighton, Thurstaston, Silloth and Morecambe (ISCZ, 2010). Intertidal fishers are also known to be active there, gathering cockle, mussel, winkle and peeler crab (ISCZ, 2010). Vessel Monitoring System (VMS) data do not provide any evidence of activity by over 15 metre UK vessels in the site. The estimated total value of UK landings from the site is £0.019m/yr. This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: Fewer than 5 UK vessels are known to bottom trawl in the site, using beam trawls to target brown shrimp throughout the year. The vessels are associated with the home port of Silloth (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £0.011m/yr (MCZ Fisheries Value Model). This is likely to be an overestimate. Discussions with the North Western Inshore Fisheries and Conservation Authority (NWIFCA) and local fishers highlight that the area covers rocky ground which is not conducive to trawling.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1 Value of landings affected — 0.011 Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.
Dredges: Fewer than 5 UK vessels are known to dredge in the site, targeting mussels from September to April (ISCZ, 2010). The vessels are associated with the home port of Silloth (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is £0.003m/yr (MCZ Fisheries Value Model). This is likely to be an overestimate. Discussions with NWIFCA and local fishers highlight that the area covers rocky ground which is not conducive to dredging.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1 Value of landings affected — 0.003
Nets: Fewer than 5 UK vessels are known to use nets in the site, targeting skate and ray and plaice from February to October (ISCZ,	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ Reference Area H, Allonby Bay</th></tr>
<tr><td colspan="2">Source of costs of the recommended Marine Conservation Zone (rMCZ)
Management scenario 1: Closure of entire rMCZ to all commercial fisheries. This includes the hand collection of intertidal flora and fauna.</td></tr>
<tr><td>2010). The vessels are associated with the home port of Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td><table><tr><td>Value of landings affected</td><td><0.001</td></tr></table>Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.</td></tr>
<tr><td>Pots and traps: Fewer than 5 UK vessels are known to use inkwell pots and traps in the site, targeting crab and lobster from April to October. The vessels are associated with the home port of Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.</td></tr>
<tr><td>Collection by hand: At least 5 UK intertidal fishers have stated that they hand-pick in the site for cockle and mussel throughout the year (ISCZ, 2010). Stakeholders have identified that winkle picking and collection of peeler crab take place in the site. Peeler crab are collected from the site between March and June but only at extreme low tides. (Area of Outstanding Natural Beauty (AONB) officer, pers. comm., 2011; Natural England, pers. comm., 2011).
The estimated value of landings from the site is £0.005m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.005</td></tr></table></td></tr>
<tr><td colspan="2">Total direct impact on UK commercial fisheries</td></tr>
<tr><td></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.019</td></tr><tr><td>GVA affected</td><td>0.008</td></tr></table>At least 5 UK vessels (bottom trawls, dredgers and nets) are affected; and at least 5 UK intertidal fishers are affected. The NWIFCA and Cumbrian fishers do not anticipate any impact upon commercial fishing in this site, because little if any activity is known to take place in this site (NWIFCA & Cumbria Fisheries, pers. comm., 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of</td></tr>
</table>

Table 2a. Commercial fisheries	**rMCZ Reference Area H, Allonby Bay**
Source of costs of the recommended Marine Conservation Zone (rMCZ) ***Management scenario 1:*** Closure of entire rMCZ to all commercial fisheries. This includes the hand collection of intertidal flora and fauna.	
	vessels fishing in the site impacted under each scenario: Scenario 1: 5
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
There is no evidence of non-UK vessels working in this site (Cowrie, 2010).	None.

Table 2b. Ports, harbours, shipping and disposal sites	**rMCZ Reference Area H, Allonby Bay**
Source of costs of the rMCZ ***Management scenario 1:*** Not applicable to site. ***Management scenario 2:*** Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Port development: The port of Maryport is located within 5km of this rMCZ. No port developments are known to be planned within the 20-year period of the Impact Assessment (IA).	*£m/yr* | Scenario 1 | Scenario 2 Cost to the operator | 0.000 | <0.001* * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. ***Scenario 1:*** Not applicable. ***Scenario 2:*** Future licence applications for port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2c. Recreation	**rMCZ Reference Area H, Allonby Bay**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling (including bait digging) and anchoring (except in emergency) in the entire site.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Angling: The site attracts between 2 to 10 anglers per day and around 40 anglers per week. (Area of Outstanding Natural Beauty (AONB) officer, pers. comm., 2011). Five angling boats visit the site all year but mostly in the summer. Anglers only fish in the site on foot during times of very low tide (angler who has been fishing in the site for 40 years, pers. comm., 2011). The best area for angling in the site is where the rough sea bed meets the sandy sea bed Bass is targeted from April to September and cod is targeted from September to March.. This site is important to anglers. It is the preferred place to fish when other favourite sites are not at their best due to the tidal range of the Solway Firth. The anglers try to mitigate any impact upon the sea bed by using a light grapple anchor and a short anchor chain. Bait collectors are also known to visit the site to 'stab' for flatfish (angler who has been fishing in the site for 40 years, pers. comm., 2011). Bait digging takes place in the site at extreme low tides (Area of Outstanding Natural Beauty (AONB) officer, pers. comm., 2011).	***Angling:*** Anglers may respond to closure of the site to angling by fishing at other favourite locations further north on the Cumbrian coast. The associated displacement of bait collection would increase environmental pressures at those locations, causing greater erosion to sand dunes and coastal paths. Fishing at other locations could also increase travel time and fuel costs and reduce the amount of time spent angling for some anglers. One angler estimated that he would experience a 15% increase in fuel costs and 15% reduction in time spent fishing. This stakeholder anticipated that anglers would continue to fish in the site regardless of a prohibition. (Angler who has been fishing in the site for 40 years, pers. comm., 2011) Closure of angling in the site will impact upon anglers who fish from at least 5 boats and an estimate of at least 40 anglers.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area H, Allonby Bay**
Education and research, flood and coastal erosion risk management (coastal defence), water pollution from activities on land; other recreational activities (including walking, swimming, dog walking, horse riding, wind surfing, kite surfing and licensed quad biking). The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area H, Allonby Bay**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Very little commercial fishing takes place in the site. However, there are a few vessels which are known to use bottom trawls, nets, dredges, and pots and traps in the site. See Table 2 for more detail. Representatives of local fisheries stated that they do not fish around the infralittoral rock and subtidal coarse sediment in the site with bottom-towed gears due to the risk of snagging the gear. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Biogenic reefs provide habitat for species that can be exploited for commercial fishing, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)).The close association between *S. spinulosa* and the pink shrimp *Pandalus montagui* has led to intensive fishing of these reefs, for example the Morecambe Bay fisheries and the Thames Estuary pink shrimp fishery, and in the Wadden Sea (Holt and others (1998) in Fletcher and others (2012)). Dense growths of bushy hydroids and bryozoans could conceivably provide an important settling area for the spat of bivalves such as the scallops *Pecten maximus* and *Aequipecten opercularis*, adults of which are often abundant in nearby areas (OSPAR (2008) in Fletcher and others (2012)). In a Belgian intertidal nursery area, the density distribution of the flatfish species plaice *Pleuronectes platessa* was significantly explained by the presence of reefs built by the polychaete *Lanica conchilega* (Rabaut (2010) in Fletcher and others (2012)). Honeycomb worm reefs in the UK also provide attachment for seaweed communities (Hill (1998) in Fletcher and others (2012)). They can stabilise mobile sediment, enabling sea bed species to establish communities (Holt and others, 1998;Jones,	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). The scenario assumes that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. Benefits defined here are not net of potential costs of the rMCZ and off-site impacts of displaced effort.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area H, Allonby Bay**
Hiscock & Connor, 2000) and can bind unstable rocky ground restricting drainage, which creates rock pool refuges for prawns, blennies and hermit crabs (Lancaster, 2008). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4b. Regulating services		**rMCZ Reference Area H, Allonby Bay**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Maryport Roads, an area of subtidal coarse sediment that partly falls within this site, was surveyed extensively between the late 1960s and 1980s and has been noted as an area of high biodiversity (e.g. Perkins (1973; 1988) in ISCZ, 2011). Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4c. Research and education	**rMCZ Reference Area H, Allonby Bay**	
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Intertidal rocky shores are a classic focus for research and there is a wealth of historical data regarding many aspects of ecology (Connell (1961) in Fletcher and others (2012)). Such baseline data are extremely useful for exploring the impacts of environmental change (Hawkins (2009) in Fletcher and others (2012)). Rocky intertidal zones have been an active area of research because communities are well defined and accessible, and so can be easily and efficiently surveyed (Hill (1998) in Fletcher and others (2012)). Peat and clay exposures are an important archaeological resource which may potentially provide historical and environmental data about human activity.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area H, Allonby Bay**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of six members of the public who commented on the potential designation of rMCZ 10, four said it was a 'good' or 'very good' idea. Reasons stated included the need to protect the area from industrial development. Two respondents said it is a good thing although they had concerns about the rMCZ affecting recreational use.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area I, Cumbrian Coast (1)

Site area (km^2): 0.12

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area I, Cumbrian Coast (1)**

1a. Ecological description

This site lies within rMCZ 11 and is positioned from Fleswick Bay to South Head, St Bees Head. The recommended site contains some of the best and only examples of high energy infralittoral and shallow infralittoral rock habitats within the Irish Sea Conservation Zones Project Area. It is comprised of typically diverse intertidal boulder communities with a distinct zoning pattern of species common to rocky shores (ISCZ, 2011).

Vertical sandstone cliffs back the shore within the site. To the north of the site the foreshore consists of extensive fine shingle and pebbles, above heavily abraded and wave-cut sculpted rock platforms, giving way to boulders on the lower shore. At the northern boundary of the site, the shore narrows into a more steeply sloping shore comprised of large boulders (Lumb, pers. comm., 2011, in ISCZ, 2011). The upper surface of the large boulders and bedrock, in the splash zone of the littoral fringe at the base of the cliffs, are dominated by lichen species such as *Xanatharia* spp. and *Caloplaca* spp. Fresh water runoff influences the presence of large quantities of green algae *Enteromorpha*. Rough periwinkles *Littorina saxatilis* are also present along with sparse brown algae (JNCC marine recorder data (2011) in ISCZ, 2011). The upper shore has a community of spiral wrack *Fucus spiralis*, knotted wrack *Ascophyllum nodosum*, common barnacles *Chthamalus* spp., common limpet *Patella vulgata* and rough periwinkles *Littorina saxatilis* (JNCC marine recorder data (2011) in ISCZ, 2011). The mid shore is dominated by barnacles *Chthamalus* spp. at the upper limit of the zone then exclusively *Balanus balanoides*. Common limpets *Patella vulgata* and dog whelks *Nucella lapillus* are common. Seaweeds, bladder wrack *Fucus vesiculosus* and red seaweed *Corallina officinalis* are abundant in rock pools. Tops of boulders exhibit dense aggregations of common mussel *Mytilus edulis* (JNCC marine recorder data (2011) in ISCZ, 2011). The lower shore presents a mixture of boulders, cobbles and pebbles. Underboulder fauna are noted as are small oarweed *Laminaria digitata*, coralline and red crusting algae. Sand-scoured boulders are seen with barnacles *Balanus crenatus* and crustose communites. Common starfish *Asterias rubens* and hermit crab *Pagurus bernhardus* are present on the sand bed (JNCC marine recorder data (2011) in ISCZ, 2011).

The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor 2000). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
High Energy Infralittoral Rock	0.02	-	Unfavourable condition	Recover to reference condition
Subtidal Mud	0.05	-	Unfavourable condition	Recover to reference condition
Subtidal Sand	0.05	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Intertidal Underboulder Communities	-	2	Unfavourable condition	Recover to reference condition
Honeycomb Worm Reefs	-	-	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Coastal development	**rMCZ Reference Area I, Cumbrian Coast (1)**
Source of costs of the rMCZ	
Management scenario 1: Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Sellafield nuclear power station may infrequently carry out environmental monitoring of the coastline at various sampling points in this rMCZ. Monitoring is undertaken to assess what impact discharges from Sellafield nuclear power station could have on people and the environment. This takes place along the coastline and in the sea. It is possible that monitoring frequency and scale could increase during the course of the Impact Assessment (IA) period of analysis (Environment Agency, pers. comm., 2012).	This activity would fall under potentially damaging or disturbing activities in the rMCZ Reference Area, and therefore would be prohibited only if it were considered to impact upon the conservation objectives of the features. Natural England (pers. comm., 2012) has advised that it is unlikely that the monitoring programme would be considered to have an impact on the features of the site. This is because the sample/monitoring area is very small in relation to the area of broad-scale habitat. With regard to features of conservation importance in the rMCZ, the potential impact of the monitoring programme upon these features would need to be considered in the absence of the MCZ designation. Therefore, it is not anticipated that additional costs would be incurred to the operator of Sellafield due to the presence of an MCZ.

Table 2b. Commercial fisheries	**rMCZ Reference Area I, Cumbrian Coast (1)**
Source of costs of the rMCZ	
Management scenario 1: Closure of entire rMCZ to all commercial fisheries. This includes hand collection of intertidal flora and fauna.	
Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), at least five UK vessels have indicated that they are active in the site using bottom trawls, pots and traps and gill nets (ISCZ, 2010). The vessels target sole, plaice, prawn, cod, crab, lobster, turbot, brill, and skate and ray (ISCZ, 2010). All the vessels are under 15 metres in length. These vessels are associated with the home ports of Fleetwood, Whitehaven and Newlyn (ISCZ, 2010). Vessel Monitoring System (VMS) data do not provide any evidence of activity by over 15 metre UK vessels in the site. Fewer than five intertidal fishers are known to hand-pick in the site, targeting winkle, cockle and mussel but there are likely to be more. The estimated total value of UK landings from the site is £0.006m/yr. This is provided for each affected gear type below.	

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries rMCZ Reference Area I, Cumbrian Coast (1)</th></tr>
<tr><th>Baseline description of UK commercial fisheries</th><th>Costs of impact of rMCZ on UK commercial fisheries</th></tr>
<tr><td>Bottom trawls: Fewer than five vessels are known to use bottom trawls in the site. They target prawn, plaice, sole, skate and ray and brill throughout the year. They are associated with the home port of Fleetwood (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>North Western Inshore Fisheries and Conservation Authority (NWIFCA) and Whitehaven fishermen's association do not feel that vessels using bottom trawls will be significantly impacted by rMCZ Reference Area I. There is little evidence, of vessels using bottom trawls within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Nets: Fewer than five vessels are known to use gill nets in the site. They target plaice, sole, turbot, cod and brill from November to May. They are associated with the home port of Whitehaven (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using nets will be significantly impacted by rMCZ Reference Area I. There is little evidence of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Pots and traps: Fewer than five vessels are known to use pots and traps in the site. They target lobsters and crabs throughout the years. They are associated with the home port of Newlyn (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using pots and traps will be significantly impacted by rMCZ Reference Area I. There is little evidence of vessels using pots and traps within the site (NWIFCA & Cumbria Fisheries, 2011).Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.</td></tr>
<tr><td>Collection by hand: Fewer than five intertidal fishers are known to hand-pick in the site, targeting winkle, cockle and mussel, but there are likely to be more. They can be active throughout the year (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.006m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.006</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that fishers collecting by hand will be significantly impacted by rMCZ Reference Area I. There is little evidence of fishers collecting by hand within the site (NWIFCA & Cumbria Fisheries, 2011). Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td>Fewer than five UK vessels (bottom trawls, potters and gill netters) and fewer than 5 intertidal fishers are affected.</td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.006</td></tr></table></td></tr>
</table>

Table 2b. Commercial fisheries	**rMCZ Reference Area I, Cumbrian Coast (1)**
	GVA affected: 0.003 NWIFCA and Whitehaven fishermen's association do not feel that fishers will be significantly impacted by rMCZ Reference Area I. There is little evidence, if any of fishing activity taking place within the site (NWIFCA & Cumbria Fisheries, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario (ISCZ, 2010): Scenario 1: < 5
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
VMS data provides no evidence of fishing by over 15 metre non-UK vessels in the site (MMO, 2011a).	None.

Table 2c. Recreation	**rMCZ Reference Area I, Cumbrian Coast (1)**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling in the entire site.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Angling: Shore and boat angling are known to take place in the area, targeting dab, cod, conger eel, wrasse, mackerel, turbot, bass and whiting. It is estimated that at least 76 anglers visit the site each year making repeat visits. This may not necessarily take place within the rMCZ though. (ISCZ, 2010). This is likely to be an overestimate as the numbers collected through interviews with recreational users were for areas larger than this site (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011).	***Angling:*** Potentially, at least 76 anglers could be affected by the closure to angling, though this is likely to be an overestimate. It is anticipated that they will respond by fishing at alternative coastal locations in the north-west of England (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). This could impact on anglers' travel costs. However, no evidence of impact was identified through the ISCZ Project's consultation with anglers. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area I, Cumbrian Coast (1)**
Flood and coastal erosion risk management (coastal defence), water pollution from activities on land and other recreation activities (including diving, wind surfing, sailing and wildlife watching). The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area I, Cumbrian Coast (1)**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). There is very little commercial fishing in the site. There are some vessels using bottom trawls, nets, and pots and traps but very little of this activity is likely to take place in the intertidal area (the extent of the site). Intertidal fishers also collect shellfish by hand in the site. See Table 2 for more detail. The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into the pelagic (open water) realm (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)). Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Infralittoral rock is a suitable habitat for inshore commercial fisheries species particularly lobster and crab (Fletcher and others (2012)). Biogenic reefs provide habitat for species that can be exploited for commercial fishing, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)). Dense growths of bushy hydroids and bryozoans could conceivably provide an important settling area for the spat of bivalves such as the scallops *Pecten maximus* and *Aequipecten opercularis*, adults of which are often abundant in	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. As the rMCZ is small, it is unclear whether it would have any impact on stocks of mobile commercial finfish species.	Anticipated direction of change: ⇧ Confidence: Low

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area I, Cumbrian Coast (1)**
nearby areas (OSPAR (2008) in Fletcher and others (2012)). In a Belgian intertidal nursery area, the density distribution of the flatfish species plaice *Pleuronectes platessa* was significantly explained by the presence of reefs built by the polychaete *Lanica conchilega* (Rabaut (2010) in Fletcher and others (2012)). Honeycomb worm reefs in the UK also provide attachment for seaweed communities (Hill (1998) in Fletcher and others (2012)). They can stabilise mobile sediment, enabling sea bed species to establish communities (Holt and others (1998), Jones, Hiscock & Connor (2000); both in Fletcher and others (2012)) and can bind unstable rocky ground restricting drainage, which creates rock pool refuges for prawns, blennies and hermit crabs (Lancaster (2008) in ISCZ (2011)). Underboulder areas may be important refuge areas for young crabs and juvenile lobsters at low tide. Boulders are also turned for the collection of periwinkles for human consumption (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4b. Regulating services		**rMCZ Reference Area I, Cumbrian Coast (1)**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Intertidal biogenic reefs also filter large volumes of water (Dubois (2006), Forster (1995), Rabaut (2010); all in Fletcher and others (2012)). The filter feeding of biogenic reefs is such that they affect energy flow over a much wider area than the reef itself (Holt and others (1998) in Fletcher and others (2012)). They play a key role in organic matter processing and nutrient cycling (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). Active sulphur cycling was found to be more dynamic in sandy sediments than in muddy sediments, with potential turnover rates of sulphur in this zone in the order of hours to minutes. Sulphate reduction has been reported as the most important process leading to a reflux of carbon dioxide into the water column (Al-Raei (2009) in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area I, Cumbrian Coast (1)**
Environmental resilience: The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Infralittoral rock is extremely rich in faunal and floral species due to the range of habitats provided by kelp communities within the subtidal zone (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). In general, honey comb worm reefs increase the habitat complexity of the surrounding environment and provide microhabitats for other organisms in crevices and cavities (Hill (2010) in Fletcher and others (2012)). The underboulder habitat, along with fissures, crevices and any spaces between adjacent boulders, forms a series of microhabitats that add greatly to the biodiversity of a shore (Hill (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (McManus (2001), Riding (2002); both in Fletcher and others (2012)). The presence of boulders in the intertidal area can help reduce coastline exposure to wave energy (UK Biodiversity Partnership (2010) in Fletcher and others (2012)).		

Table 4c. Research and education		**rMCZ Reference Area I, Cumbrian Coast (1)**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. It is known that intertidal underboulder communities are used for education, research and nature watching. These activities take place in coastal areas with relatively easy access to the shore and generally involve overturning boulders to view the flora/fauna which lives underneath. Many organisations, such as the Wildlife Trusts and the Marine Life Information Network (MarLIN), co-ordinate such activities for educational and research purposes for schools, community groups and tourists.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change:  Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area I, Cumbrian Coast (1)**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs).. Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' Campaign (Ranger and others, 2011), six 'nominated sites' fall within the boundary of Recommended MCZ Reference Area I. The majority of nominations cited personal attachment to the site, 'spectacular scenery', and a sense that the site 'appears unspoilt' as reasons for protection. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H). A survey of beach users in coastal areas of the north-west of England was undertaken in 2011 by liaison officers in the Irish Sea Conservation Zones Project Area. Of 19 members of the public who commented on the potential designation of rMCZ 11, 18 of them said it was a 'good' or 'very good' idea. Reasons stated included the need to conserve and protect marine biodiversity for future generations as long as it does not affect recreational use of the site.	Anticipated direction of change: Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area J, Cumbrian Coast (2)

Site area (km^2): 1.06

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts **rMCZ Reference Area J, Cumbrian Coast (2)**

1a. Ecological description

This site lies within the boundary of the rMCZ11 and is situated in Saltom Bay on the Cumbrian coast north of St Bees Head. The site includes an area known locally as Byerstead Fault, a recovering intertidal zone that is showing a return of species diversity following the closure of the Marchon chemical plant and its associated outfall. With time, this area may re-colonise and exhibit similar species richness as the nationally important rocky and boulder shores of St Bees Head and Cunning Point (Recommended MCZ Reference Area T). Recommended MCZ Reference Area J has been recommended for designation for both intertidal and subtidal features. It incorporates areas of high energy intertidal rock and intertidal boulder communities with mixed sediments.

Boulders within the shallow sublittoral zone exhibit crusts of honeycomb worm *Sabellaria alveolata* tubes, barnacles *Balanus cretanus*, red furry encrusting algae *Rhodothamniella floridula*, red pool algae *Cerarium nodosum* and green enteromorpha seaweed *Ulva linza*. Within this community it is important to note that, in 2010, mussel sprat *Mytilus edulis*, which refers to newly settled bivalve larvae that has begun to develop a shell, was encountered for the first time in 17 years of surveying, and is wholly indicative of vastly improved water quality. In the low water mark there was also a varied underboulder community including tube worms, crabs, anemones, sea squirts (another new addition in 2010) and bryozoans (Lancaster (2010) in ISCZ, 2011).

The mid-shore zone introduces more new species including toothed wrack *Fucus seratus*, bladder wrack *Fucus vesiculosus*, limpets *Patella vulgata*, barnacles *Semibalanus balanoides*, periwinkles *Littorina* spp. and dog whelks *Nucella lapillus*. This area was previously dominated by seaweeds, which is unusual for the rocky Cumbrian coast and may be linked to the relatively poor water quality at the site. However, recent surveys indicate a re-establishment of a population of grazers, which may bring about a mid to low shore barnacle–limpet zone as seen on other true rocky shores such Cunning Point and St Bees Head. The upper shore is dominated by spiral wrack (*Fucus spiralis*, green enteromorpha algae *Ulva linza* and green algae *Blindingia minima* (Lancaster (2011) in ISCZ, 2011).

The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
High Energy Intertidal Rock	0.03	-	Unfavourable condition	Recover to reference condition
Intertidal Mixed Sediments	0.03	-	Unfavourable condition	Recover to reference condition
Subtidal Sand	0.94	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Intertidal Underboulder Communities	-	2	Unfavourable condition	Recover to reference condition
Subtidal Sands and Gravels	0.17	-	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Coastal development	**rMCZ Reference Area J, Cumbrian Coast (2)**
Source of costs of the rMCZ ***Management scenario 1:*** Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Sellafield nuclear power station may infrequently carry out environmental monitoring of the coastline at various sampling points in this rMCZ. Monitoring is undertaken to assess what impact discharges from Sellafield nuclear power station could have on people and the environment. This takes place along the coastline and in the sea. It is possible that monitoring frequency and scale could increase during the course of the Impact Assessment (IA) period of analysis (Environment Agency, pers. comm., 2012).	This activity would fall under potentially damaging or disturbing activities in the rMCZ Reference Area, and therefore would be prohibited only if it were considered to impact upon the conservation objectives of the features. Natural England (pers. comm., 2012) has advised that it is unlikely that the monitoring programme would be considered to have an impact on the features of the site. This is because the sample/monitoring area is very small in relation to the area of broad-scale habitat. With regard to features of conservation importance in the rMCZ, the potential impact of the monitoring programme upon these features would need to be considered in the absence of the MCZ designation. Therefore, it is not anticipated that additional costs would be incurred to the operator of Sellafield due to the presence of an MCZ.

Table 2b. Commercial fisheries	**rMCZ Reference Area J, Cumbrian Coast (2)**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of entire rMCZ to all commercial fisheries. This includes hand collection of intertidal flora and fauna.	
Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), at least five UK vessels have indicated that they are active in the site using bottom trawls, pots and traps, gill nets and hand lines (ISCZ, 2010). The vessels target sole, plaice, prawn, pollack, bass, cod, crab, lobster, turbot and brill (ISCZ, 2010). All but one of the vessels are under 15 metres in length. These vessels are associated with the home ports of Fleetwood, Maryport, Whitehaven and Newlyn (ISCZ, 2010). Vessel Monitoring System (VMS) data do not provide any evidence of activity by over 15 metre UK vessels in the site. Fewer than five intertidal fishers are known to work in the site, targeting salmon, winkle, cockle and mussel, but there are likely to be more. The estimated total value of UK landings from the site is £0.007m/yr. This is provided for each affected gear type below.	
Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries rMCZ Reference Area J, Cumbrian Coast (2)</th></tr>
<tr><td>Bottom trawls: Fewer than five vessels are known to use bottom trawls in the site. They use single trawls to target plaice, pollack and prawn throughout the year. These vessels are associated with the home ports of Fleetwood and Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>North Western Inshore Fisheries and Conservation Authority (NWIFCA) and Whitehaven fishermen's association do not feel that vessels using bottom trawls will be significantly impacted by rMCZ Reference Area J. There is little evidence, if any of vessels using bottom trawls within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Nets: Fewer than five vessels are known to use nets in the site throughout the year. They use gill nets to target plaice, bass, cod, turbot, brill and sole. These vessels are associated with the home ports of Maryport and Whitehaven (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using nets will be significantly impacted by rMCZ Reference Area J. There is little evidence, if any of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Pots and traps: Fewer than five vessels are known to use pots and traps in the site throughout the year. They target lobster and crab. These vessels are associated with the home ports of Maryport and Newlyn (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using pots and traps will be significantly impacted by rMCZ Reference Area J. There is little evidence, if any of vessels using pots and traps within the site (NWIFCA & Cumbria Fisheries, 2011). Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.</td></tr>
<tr><td>Hooks and lines: Fewer than five vessels are known to use hand lines in the site throughout the year. They target bass, cod and plaice. They are associated with the home port of Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using hooks and lines will be significantly impacted by rMCZ Reference Area J. There is little evidence, if any of vessels using hooks and lines within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Collection by hand: At least five intertidal fishers are known to collect winkle, cockle and mussel in the site throughout the year but there are likely to be more (ISCZ, 2010).
The estimated value of landings from the site is £0.006m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.006</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that fishers collecting by hand will be significantly impacted by rMCZ Reference Area J. There is little evidence, if any of fishers</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries rMCZ Reference Area J, Cumbrian Coast (2)</th></tr>
<tr><td></td><td>collecting by hand within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td>At least five UK vessels (bottom trawls and dredgers) are known to be active in the site.</td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.007</td></tr><tr><td>GVA affected</td><td>0.003</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that fishers will be significantly impacted by rMCZ Reference Area J. There is little evidence, if any of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario (ISCZ, 2010):
Scenario 1: 5</td></tr>
<tr><th>Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td>VMS data provides no evidence of fishing by over 15 metre non-UK vessels in the site (MMO, 2011a).</td><td>None.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2c. Ports, harbours, shipping and disposal sites rMCZ Reference Area J, Cumbrian Coast (2)</th></tr>
<tr><td colspan="2">Source of costs of the rMCZ
Management scenario 1: Not applicable to site.
Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.</td></tr>
<tr><th>Baseline description of activity</th><th>Costs of impact of rMCZ on the sector</th></tr>
<tr><td>Port development: The port of Whitehaven is located within 5km of this rMCZ. No port developments are known to be planned within the 20-year period of the IA.</td><td><table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.000</td><td><0.0001*</td></tr></table>* This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information.
Scenario 1: Not applicable.</td></tr>
</table>

	Scenario 2: Future licence applications for port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2d. Recreation	**rMCZ Reference Area J, Cumbrian Coast (2)**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling in the entire site.	
Baseline description of activity	**Costs of impact of rMCZ upon the sector**
Angling: Shore and boat angling are known to take place in the area, targeting dab, cod, conger eel, wrasse, common skate, whitefish and whiting. It is estimated that at least 76 anglers visit the site each year making repeat visits, This may not necessarily take place within the rMCZ though. (ISCZ, 2010). This is likely to be an overestimate as the data collected through interviews with recreational users were for areas larger than this site (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011).	***Angling:*** Potentially, at least 76 anglers could be affected by the closure to angling. This is likely to be an overestimate as the numbers collected through interviews with recreational users were for areas larger than this site (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). It is anticipated that they will respond by fishing at alternative coastal locations in the north-west of England (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). This could impact on anglers' travel costs. However, no evidence of impact was identified through the ISCZ Project's consultation with anglers. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area J, Cumbrian Coast (2)**
Flood and coastal erosion risk management (coastal defence), water pollution from activities on land and other recreation activities (including diving, sailing, wildlife watching. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area J, Cumbrian Coast (2)**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Fishing vessels using bottom trawls, pots and traps, mid-water trawls, nets, dredges, and hooks and lines are known to fish in the area; however, it is unlikely that they all work in the intertidal area (the extent of this rMCZ). Intertidal fishers also collect mussels, clams and periwinkles by hand. See Table 2 for more detail. Intertidal sand, muddy sand and mixed sediments are important spawning and nursery grounds (Fortes (2002) in Fletcher and others (2012)) for species including plaice (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Sole *Solea solea* and gadoids often visit sandy and mixed sediment (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Sandflats are frequented by sea bass and flounder as feeding grounds to predate on polychaetes and crustaceans, while migratory species such as salmon and shad pass through sandflat areas en route to other wetland habitats (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Infralittoral rock is a suitable habitat for inshore commercial fisheries species, particularly lobster and crab (Fletcher and others (2012)). Intertidal rock habitats are important sources of larval plankton upon which commercially important fish species feed, including mussels and larval fish of plaice and mackerel (Fletcher and others (2012)). Underboulder areas may be important refuge areas for young crabs and juvenile lobsters at low tide. Boulders are also turned for the collection of periwinkles for human consumption (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). . The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries from vessels using these gear types in the site. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. Benefits defined here are not net of potential costs of the rMCZ and off-site impacts of displaced effort. As the rMCZ is small it is unclear whether it would have any impact on stocks of mobile commercial finfish species.	Anticipated direction of change: ⇧ Confidence: Low

Table 4b. Regulating services	**rMCZ Reference Area J, Cumbrian Coast (2)**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste	If the conservation objectives of the features are achieved, the	Anticipated

Table 4b. Regulating services		**rMCZ Reference Area J, Cumbrian Coast (2)**
and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Active sulphur cycling was found to be more dynamic in sandy sediments than in muddy sediments. Sulphate reduction has been reported as the most important process leading to a reflux of carbon dioxide into the water column (Al-Raei (2009) in Fletcher and others (2012)). Nitrate is removed from coastal waters by microbial biofilm on intertidal rock (Magalhaes, 2003). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). Intertidal rock is generally of high biodiversity (Hill (1998) in Fletcher and others (2012)). On exposed rock, mussels, limpets, barnacles, fucoids and red seaweed are found. Cracks, crevices and rock pools increase species richness and abundance (Baker (1987) in Fletcher and others (2012)).During the summer, ephemeral green and red seaweeds dominate intertidal rock (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The underboulder habitat, along with fissures, crevices and any spaces between adjacent boulders, forms a series of microhabitats that add greatly to the biodiversity of a shore (Hill (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Intertidal rock protects the coastline from erosion by reducing the wave energy that reaches the shore (Anthony (2008) and Hill (1998) in Fletcher and others (2012)). The presence of boulders in the intertidal area can help reduce coastline exposure to wave energy (UK Biodiversity Partnership (2010) in Fletcher and others (2012)).	features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	direction of change: Confidence: Moderate

Table 4c. Research and education	**rMCZ Reference Area J, Cumbrian Coast (2)**	
Baseline	**Beneficial impact**	
Research: The extent of research undertaken in the site is not known. Intertidal rocky shores are a classic focus for research and there is a wealth of historical data regarding many aspects of ecology (Connell (1961) in Fletcher and others (2012)). Such baseline data are extremely useful for exploring the impacts of environmental change (Hawkins (2009) in Fletcher and others (2012)). Schoolchildren are taken to an area north of Saltom Bay. It is not clear if they visit the area covered by Recommended MCZ Reference Area J itself, but the designation could benefit educational trips to the area (Natural England, pers. comm., 2011). It is known that intertidal underboulder communities are used for education, research and nature watching. These activities take place in coastal areas with relatively easy access to the shore and generally involve overturning boulders to view the flora/fauna which lives underneath. Many organisations, such as the Wildlife Trusts and the Marine Life Information Network (MarLIN), co-ordinate such activities for educational and research purposes for schools, community groups and tourists.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area J, Cumbrian Coast (2)**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area K, Tarn Point

Site area (km^2): 1.07

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area K, Tarn Point**

1a. Ecological description

This is a small intertidal site situated adjacent to Tarn Point on the Cumbrian coast. It is a stand-alone rMCZ Reference Area and is not contained within a larger rMCZ. The benthic habitat is comprised of intertidal biogenic reefs and high energy infralittoral rock. The biogenic reefs include blue mussel *Mytilus edulis* beds and honeycomb worm *Sabellaria alveolata* reefs. The site contains some of the best and most studied examples of honeycomb worm reef in the UK which in places reaches up to 60cm in height. Blue mussel beds and honeycomb worms provide a stable, hard substrate in areas of otherwise soft sediments or unstable rocky ground and this underlies their ecological importance. They stabilise the sediment, forming hard structures to which other sessile (or immobile) organisms can attach; and they provide a heterogeneous or varied surface structure, for example, crevices which give shelter to other animals; and the accumulated faeces and associated sediments are an important food source for other species (Holt and others (1998) in ISCZ, 2011). As a result, both blue mussel beds and honeycomb worm reefs support a varied biological community. The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Intertidal Sand and Muddy Sand	0.40	-	Unfavourable condition	Recover to reference condition
Intertidal Biogenic Reefs	0.23	-	Unfavourable condition	Recover to reference condition
High Energy Infralittoral Rock	0.002	-	Unfavourable condition	Recover to reference condition
Subtidal Sand	0.43	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Blue Mussel Beds	-	1	Unfavourable condition	Recover to reference condition
Honeycomb Worm Reefs	0.34	11	Unfavourable condition	Recover to reference condition
Subtidal Sands and Gravels	1.07	12	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage	**rMCZ Reference Area K, Tarn Point**
Source of costs of the rMCZ Increase in costs of assessing environmental impacts for future licence applications. Archaeological excavations, surface recovery and intrusive surveys will be prohibited from the entire site. Diver trails, visitors and non-intrusive surveys will be allowed.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
A logboat was reported on the margins of the site in 1974 (English Heritage, pers. comm., 2012). Peat is also reported in the site (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the future as it is relevant to its National Heritage Protection Plan (theme 3A1.2).	An extra cost would be incurred in the assessment of environmental impacts made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. If archaeologists respond to the prohibition of excavation by undertaking an alternative archaeological excavation in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the Impact Assessment (IA). The prohibition of excavation and therefore interpretation of archaeological evidence from the site will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 2b. Commercial fisheries	**rMCZ Reference Area K, Tarn Point**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of entire rMCZ to all commercial fisheries. This includes hand collection of intertidal flora and fauna.	
Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), at least five UK vessels have indicated that they are active in the site using bottom trawls, pots and traps, and nets (ISCZ, 2010). The vessels target sole, plaice, prawn, cod, crab, lobster, turbot, brill, bass, mullet, pollack, and skate and ray (ISCZ, 2010). All the vessels are under 15 metres in length. These vessels are associated with the home ports of Whitehaven, Fleetwood, Barrow, Kings Lynn and Flookburgh (ISCZ, 2010). Fewer than 5 intertidal fishers are known to collect cockle, winkle and mussel by hand in the site (ISCZ, 2010). Vessel Monitoring System (VMS) data do not provide any evidence of activity by over 15 metre UK vessels in the site. The estimated total value of UK landings from the site is £0.017m/yr. This is provided for each affected gear type below.	
Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: Fewer than five vessels are known to use bottom trawls in the site. They target prawn and plaice from April to November. They are associated with the home port of Fleetwood (ISCZ, 2010). VMS data	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1 Value of landings affected — 0.001

<table>
<tr><th colspan="2">Table 2b. Commercial fisheries rMCZ Reference Area K, Tarn Point</th></tr>
<tr><td>provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.001m/yr (MCZ Fisheries Value Model).</td><td>North Western Inshore Fisheries and Conservation Authority (NWIFCA) and Whitehaven fishermen's association do not feel that vessels using bottom trawls will be significantly impacted by rMCZ Reference Area K. There is little evidence, if any of vessels using bottom trawls within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Nets: Fewer than five vessels are known to use gill nets, fixed nets and drift nets in the site throughout the year. They target cod, plaice, sole, skate and ray, turbot, brill, bass, mullet, pollack, salmon and flounder. These vessels are associated with the home ports of Whitehaven, Barrow and Flookburgh (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using nets will be significantly impacted by rMCZ Reference Area K. There is little evidence, if any of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Pots and traps: Fewer than five vessels are known to use pots and traps in the site to target crab and lobster throughout the year. They are associated with the home port of Whitehaven (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is £0.009m/yr (MCZ Fisheries Value Model).
This is likely to be a mapping resolution error as evidence of potting activity in the site is sourced to FisherMap. However, discussions with local fishers and NWIFCA do not identify any potting activity in this site.</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.009</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using pots and traps will be significantly impacted by rMCZ Reference Area K. There is little evidence, if any of vessels using pots and traps within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Collection by hand: Fewer than five intertidal fishers are known to collect cockle, mussel and winkle in the site throughout the year (ISCZ, 2010). NWIFCA and Cumbria Fisheries confirm that winkle gathering takes place in the site, although this is dependent on demand from the European market. Crab hooking also takes place.
The estimated value of landings from the site is £0.007m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.007</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that fishers collecting by hand will be significantly impacted by rMCZ Reference Area K. There is little evidence, if any of fishers collecting by hand within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td>Fewer than five UK vessels (bottom trawls, pots and traps, and nets) are affected.</td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.017</td></tr><tr><td>GVA affected</td><td>0.008</td></tr></table></td></tr>
</table>

Table 2b. Commercial fisheries	**rMCZ Reference Area K, Tarn Point**
	NWIFCA and Whitehaven fishermen's association do not feel that fishers will be significantly impacted by rMCZ Reference Area K. There is little evidence, if any of fishing taking place within the site (NWIFCA & Cumbria Fisheries, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario (ISCZ, 2010): Scenario 1: < 5
Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
VMS data provides no evidence of fishing by over 15 metre non-UK vessels in the site (MMO, 2011a).	None.

Table 2c. National defence	**rMCZ Reference Area K, Tarn Point**
Source of costs of the rMCZ ***Management scenario 1:*** Mitigation of impacts of Ministry of Defence activities on features protected by the suite of rMCZs will be provided by additional planning considerations during operations and training. It is not known whether mitigation will be required for features protected by this site. The Ministry of Defence will also incur costs in revising environmental tools and charts to include MCZs.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
The Ministry of Defence is known to make use of part of the site for a military firing range.	It is not known whether this rMCZ Reference Area will impact on the Ministry of Defence's use of the site. However, the impact on the UK economy is not likely to be significant. Impacts of rMCZs on the Ministry of Defence's activities are assessed in Annex J.

Table 2d. Ports, harbours, shipping and disposal sites	**rMCZ Reference Area K, Tarn Point**
Source of costs of the rMCZ ***Management scenario 1:*** Not applicable to this site. ***Management scenario 2:*** Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Port development: The port of Ravenglass is located within 5km of this rMCZ. No port developments are known to be planned within the 20-year period of the IA.	<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.000</td><td><0.001*</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a

	result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. ***Scenario 1*:** Not applicable. ***Scenario 2:*** Future licence applications for port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2e. Recreation	**rMCZ Reference Area K, Tarn Point**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling in the entire site. Prohibition of extraction of species by divers.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Angling: Shore and boat angling are known to take place in the area, targeting cod, conger eel, flounder and whiting. It is estimated that at least 43 anglers visit the site each year making repeat visits. This may not necessarily take place within the rMCZ though. (ISCZ, 2010). This is likely to be an overestimate as the numbers collected through interviews with recreational users were for areas larger than this site. ***Diving:*** General/scenic diving and observation of wildlife trips are known to take place in the area, on average in one day of every month from April to October. There are approximately 12 people in every diving trip. This may not necessarily take place within the rMCZ though. (ISCZ, 2010).	***Angling:*** At least 43 anglers could be affected by the closure to angling, though this is likely to be an overestimate. It is anticipated that they will respond by fishing at alternative coastal locations in the north-west of England (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). This could impact on anglers' travel costs. However, no evidence of impact was identified through the ISCZ Project's consultation with anglers. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant. ***Diving:*** The prohibition on removal of material from the site is likely to have a negligible impact on diving. No evidence of impact is available from consultation with local diving clubs.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area K, Tarn Point**
Flood and coastal erosion risk management (coastal defence), water pollution from activities on land and other recreation activities (including wind surfing and sailing). The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area K, Tarn Point**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). There is very little commercial fishing in the site. There are some vessels using bottom trawls, nets, and pots and traps but very little of this activity is likely to take place in the intertidal area (the extent of the site). Intertidal fishers also collect shellfish by hand in the site. See Table 2 for more detail. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Intertidal sand, muddy sand and mixed sediments are important spawning and nursery grounds (Fortes (2002) in Fletcher and others (2012)) for species including plaice (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Sole *Solea solea* and gadoids often visit sandy and mixed sediment (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Sandflats are frequented by sea bass and flounder as feeding grounds to predate on polychaetes and crustaceans, while migratory species such as salmon and shad pass through sandflat areas en route to other wetland habitats (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Infralittoral rock is a suitable habitat for inshore commercial fisheries species, particularly lobster and crab (Fletcher and others (2012)). Intertidal rock habitats are important sources of larval plankton upon which commercially important fish species feed, including mussels and larval fish of plaice and mackerel (Fletcher and others (2012)). Biogenic reefs provide habitat for shellfish and fish, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)). Reefs support crevice-dwelling animals such as large crabs and lobsters as well as the queen scallop	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. As the rMCZ is small it is unclear whether it would have any impact on stocks of mobile commercial finfish species.	Anticipated direction of change: ⇧ Confidence: Low

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area K, Tarn Point**
Aequipecten opercularis (Hill and others (1998) and references therein; in Fletcher and others (2012)). They can also support the spat of bivalves such as scallops (OSPAR (2008) in Fletcher and others (2012)). Honeycomb worm reefs in the UK also provide attachment for seaweed communities (Hill (1998) in Fletcher and others (2012)). They can stabilise mobile sediment, enabling sea bed species to establish communities (Holt and others (1998), Jones, Hiscock & Connor (2000) in Fletcher and others (2012)) and can bind unstable rocky ground restricting drainage, which creates rock pool refuges for prawns, blennies and hermit crabs (Lancaster (2008) in ISCZ (2011)). Underboulder areas may be important refuge areas for young crabs and juvenile lobsters at low tide. Boulders are also turned for the collection of periwinkles for human consumption (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when not in reference condition.		

Table 4b. Regulating services		**rMCZ Reference Area K, Tarn Point**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige, 2006). Intertidal biogenic reefs also filter large volumes of water (Dubois (2006); Forster (1995); Rabaut (2010) in Fletcher and others (2012)). The filter feeding of biogenic reefs is such that they affect energy flow over a much wider area than the reef itself (Holt and others (1998) in Fletcher and others (2012)).. They play a key role in organic matter processing and nutrient cycling (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). Fundamental ecosystem processes including nutrient cycling are evident in intertidal sand and muddy sand. Dissolved organic carbon is supplied through the breakdown of	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area K, Tarn Point**
organisms, exudation and excretion as well as by hydrolysis of particulate carbon (Fletcher and others (2012)). Active sulphur cycling was found to be more dynamic in sandy sediments than in muddy sediments, with potential turnover rates of sulphur in this zone in the order of hours to minutes. Sulphate reduction has been reported as the most important process leading to a reflux of carbon dioxide into the water column (Al-Raei (2009) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership, 2010) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). Muddy sand supports communities of polychaetes and bivalves, including the lugworm, cockles and may also have eelgrass (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Biogenic reefs increase the habitat complexity of the surrounding environment and provide microhabitats for other organisms in crevices and cavities (Hill (2010) in Fletcher and others (2012)) Blue mussel beds in areas of soft sediment provide an area of hard substrata (Hill (2010) in Fletcher and others (2012)) and create biogenic structurally complex habitats that provide refuge for a range of flora and fauna not observed on surrounding sediments (Hill, 2010). Infralittoral rock is extremely rich in faunal and floral species due to the range of habitats provided by kelp communities within the subtidal zone (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Intertidal rock protects the coastline from erosion by reducing the wave energy that reaches the shore (Anthony, 2008) (Hill (1998) in Fletcher and others (2012)). The presence of boulders in the intertidal area can help		

Table 4b. Regulating services		**rMCZ Reference Area K, Tarn Point**
reduce coastline exposure to wave energy (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (McManus (2001), Riding (2002); both in Fletcher and others (2012)). Muddy shores (intertidal sand and muddy sand) are important for coastal protection acting as buffers against incoming wave energy (Fortes (2002) in Fletcher and others (2012).		

Table 4c. Research and education		**rMCZ Reference Area K, Tarn Point**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ Reference Area K Tarn Point**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area S, North St George's Channel (2)

Site area (km^2): 38.09

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts	**rMCZ Reference Area S, North St George's Channel (2)**

1a. Ecological description

This site is located within the north-eastern portion of rMCZ 3, located approximately 23km north-west from the coast of Anglesey in north Wales. The depth of the area ranges from 50 metres to 100 metres and it is located approximately 23km/12 nautical miles (nm) north-west from the coast of Anglesey in north Wales. The predominant broad-scale habitat types present in the area are the subtidal coarse sediment, subtidal sand subtidal mixed sediment. In this region, such sediments tend to support an abundance of bivalves and polychaete worms. Bolam and others (2010, in ISCZ, 2011) identified molluscs and annelid worms which live within the sediment as the main secondary producers in this part of the Irish Sea. These animals are a key part of the food chain; they recycle organic matter from within the sediment, linking primary production from the plankton to predatory fish (Bolam and others (2010) in ISCZ, 2011).

The horse mussel *Modiolus modiolus* beds in this area support a range of filter-feeding animals, for example the acorn barnacle *Balanus balanus*, hydroids and soft corals (Rees (2005) in ISCZ, 2011). Horse mussel beds support a range of other suspension feeders, providing a link in the food chain by connecting primary production in the plankton to the sea bed organisms (Tyler-Walts (2007) in ISCZ 2011). Bivalves also play a key role in unlocking the energy of primary producers, which in the sea are the phytoplankton (microscopic algae), making it available to be used as food by other creatures. As such, primary producers are the very basis of the food chain that provides the fish consumed by humans.

Tube-dwelling Ross worms *Sabellaria spinulosa* have also been recorded in the horse mussel beds (Rees (2005) in ISCZ, 2011). *Sabellaria spinulosa* ingest particles from the surrounding water and from this excrete a cement-like substance to form the tube in which they live. Collectively these worms can form dense aggregations, or reefs, which stabilise the substrate and provide an important habitat for a host of other species (Maddock (2010) in ISCZ, 2011). However, it is not confirmed whether these localised occurrences of *Sabellaria spinulosa* currently constitute a biogenic reef. Therefore, the species has been noted as present but not designated as a reef.

Basking sharks *Cetorhinus maximus* are now marked as endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. St George's Channel is a key part of their migratory route, utilising the nutrient-rich waters formed by tidal mixing currents (Stephan and others (2011) in ISCZ, 2011). Recommended MCZ Reference Area 3 is an important area for foraging sea birds that breed in Welsh (often Special Protection Area (SPA)) colonies. Gannets, Manx shearwaters, fulmars, guillemots and puffins are sea bird species that are highly likely to forage at this location. The northern section of the site contains an important pelagic front, which is heavily used by a number of species. Locally, guillemots *Uria aalge* feed on sand eels, herrings and sprats; puffins *Fratercula arctica* feed on sand eels and capelins; gannets *Morus bassanus* feed on mackerel, herrings and sand eels; Manx shearwaters *Puffinus puffinus* feed on herrings, sprats, whitebait and pilchards (RSPB, pers comm., 2011). The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor 2000). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	**Area of feature (km^2)**	**No. of point records**	**Baseline**	**Impact of MCZ**

Broad-scale Habitats				
Moderate Energy Circalittoral Rock	5.60	-	Unfavourable condition	Recover to reference condition
Subtidal Mixed Sediment	18.72	-	Unfavourable condition	Recover to reference condition
Subtidal Coarse Sediment	12.47	-	Unfavourable condition	Recover to reference condition
Subtidal Sands	3.16	-	Unfavourable condition	Recover to reference condition
Subtidal Biogenic Reefs	13.78	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Horse Mussel Beds	13.77	1	Unfavourable condition	Recover to reference condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries — **rMCZ Reference Area S, North St George's Channel (2)**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries apart from mid-water trawling.

Management scenario 2: Closure of entire rMCZ to all commercial fisheries.

Summary of all UK commercial fisheries: The site lies completely the 12 nautical miles (nm) limit. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b), at least 13 vessels are known to fish in this site (both under and over 15 metre vessels) (ISCZ, 2010). These vessels use bottom trawls, dredges, mid-water trawls, pots and traps, hooks and lines, and nets. They target nephrops, brill, scallop, whitefish, shrimp, herring, lobster, skate and ray, turbot, monkfish, spurdog, dogfish and catfish. Vessel Monitoring System (VMS) data indicate the use of pots and traps by over 15 metre UK vessels in the site (MMO, 2011a). The estimated total value of UK landings from the site is £0.002m/yr (MCZ Fisheries Value Model). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: Fewer than 5 UK vessels are known to use bottom trawls (twin-rig otter trawls) in the site. They target nephrops and whitefish throughout the year. These are Northern Irish and Scottish vessels and are associated with the home ports of Ardglass, Kirkcudbright and Kilkeel (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). There is no evidence from VMS data that over 15 metre UK vessels are active in the site (MMO, 2011a). The estimated value of landings from the site is £0.001m/yr.	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1: 0.001 — Scenario 2: 0.001 Stakeholders have not provided a description of impact.
Dredges: Fewer than 5 UK vessels are known to dredge in the site. They target scallop throughout the year. These are Scottish	The annual value of UK landings affected is estimated to fall within the following range:

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th colspan="2">rMCZ Reference Area S, North St George's Channel (2)</th></tr>
<tr><td colspan="2">and Northern Irish vessels and are associated with the home ports of Kirkcudbright and Kilkeel (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). There is no evidence from VMS data (for over 15 metre vessels) that this activity takes place in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2"><table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Mid-water trawls: Fewer than 5 UK mid-water trawlers are known to fish in the site. They target herring from July to December. These are Welsh, Isle of Man and Northern Irish vessels and are associated with the home ports of Ardglass, Douglas and Bangor (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). There is no evidence from VMS data (for over 15 metre vessels) that this activity takes place in the site (MMO, 2011a).
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<tr><td colspan="2">Pots and traps: Fewer than 5 UK potters are known to fish in the site. They target whelk throughout the year. These are Welsh vessels and are associated with the home port of Holyhead (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). VMS data indicates the use pots and traps by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><td colspan="2">Nets: Fewer than 5 UK vessels are known to fish in the site. These are Welsh vessels using gill nets to target brill, monkfish, turbot, lobster and skate and ray from April to October (ISCZ, 2010). They are associated with the home port of Conwy (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). There is no evidence from VMS data (for over 15 metre vessels) that this activity takes place in the site (MMO, 2011a).</td><td colspan="2">The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ Reference Area S, North St George's Channel (2)</th></tr>
<tr><td>The estimated value of landings from the site is <£0.001m/yr.</td><td></td></tr>
<tr><td>Hooks and lines: Fewer than 5 UK vessels are known to fish in the site. These are Welsh vessels using drift nets to target dogfish, catfish, spurdog and skate and ray throughout the year (ISCZ, 2010). They are associated with the home port of Conwy (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011). There is no evidence from VMS data (for over 15 metre vessels) that this activity takes place in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr.</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td><0.001</td><td><0.001</td></tr></table>Stakeholders have not provided a description of impact.</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Value of landings affected</td><td>0.002</td><td>0.002</td></tr><tr><td>GVA affected</td><td>0.001</td><td>0.001</td></tr></table>At least 10 UK vessels are likely to be affected (ISCZ, 2010). Stakeholder meetings gave no indication of how many vessels are active in the site but suggested that the number was low (Stakeholder Focus Meeting, 2011).
Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in site impacted under each scenario.
Scenario 1: 10
Scenario 2: 12</td></tr>
<tr><th>Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td>VMS data (for over 15 metre vessels) suggest that Belgian beam trawlers fish in the site (MMO, 2011a).</td><td>Comments from representatives of Belgian fisheries: Regarding Scenarios 1 and 2: In the view of Belgian fisheries representatives, the proposed restrictions would be a financial 'disaster' for the Belgian fleet and they anticipate that eight Belgian vessels that currently fish in the Irish Sea would be forced to leave the fishing industry. Displacement of effort of Belgian vessels that fish in the site will increase the concentration of vessels into smaller areas, which will increase competition. If fishing grounds are reduced in area, it is anticipated that fishing quota will also be restricted with significant financial repercussions for the Belgian fishing fleet. The Belgian fleet is gradually adopting a new gear type, the Sumwing, which is a lighter gear and impacts the sea bed less. However, if this gear type is prohibited also in the rMCZ, there would be no alternative but for the Belgian vessels to stop fishing in the Irish Sea</td></tr>
</table>

Table 2a. Commercial fisheries	**rMCZ Reference Area S, North St George's Channel (2)**
	and potentially stop fishing altogether. It is not feasible for Belgian vessels to adapt to pots and traps to fish in the Irish Sea. (Belgian Fisheries Representative, 2011). Quantitative estimates of impact are not available.

Table 2b. Renewable energy: **rMCZ Reference Area S, North St George's Channel (2)**

Source of costs of the rMCZ

Management scenario 1: Increase in costs of assessing environmental impacts for licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed relative to the mitigation provided in the baseline).

Management scenario 2: Increase in costs of assessing environmental impacts for licence applications and increase in cable protection installation costs for power export cables and inter-array cables (relative to the mitigation provided in the baseline).

Baseline description of activity

There is currently no renewable energy activity, existing or proposed, in this site. However, the National Grid 2011 Offshore Development Information Statement (ODIS) indicates that an offshore DC cable will be required in the vicinity of this site within the 20-year period of the Impact Assessment (IA) in order to connect the offshore wind farms to the National Electricity Transmission System. This is anticipated to link to Centrica's Round 3 (Zone 9) wind farm development in the Irish Sea. No further information is available. The rMCZ also lies in close proximity to Centrica's Round 3 (Zone 9) wind farm area of search.

Costs of impact of rMCZ on the sector

The estimated cost to renewable energy developers operating in this rMCZ is expected to fall within the following range of scenarios:

£m/yr	Scenario 1	Scenario 2
Cost to the operator	Confidential	0.510
GVA affected		0.510

Scenario 1: The licence applications for wind farms proposed in the Round 3 Irish Sea area of search will need to consider the potential effects of the developments on achieving the conservation objectives of the rMCZ's features. This is expected to result in an additional one-off cost (for extra consultant/staff time). Centrica has requested that the cost estimates it has provided for this are not provided here due to commercial sensitivity. Consequently, an average of estimates provided by Centrica and the other seven developers is used for this rMCZ (in both scenarios). Annex N13 and Annex H14 provide more detail.

Scenario 2: In addition to the increased costs for assessment set out under Scenario 1, Scenario 2 includes costs of additional mitigation. It is assumed that the proposed and not-yet-consented ODIS power export cable route will be re-routed around the rMCZ reference area. This is expected to result in an additional one-off cost of £10.100m in 2022 (based on estimated additional cost of £1.01m/km for power export cable only; year not known so mid-point year of IA period used). The exact cable route is not yet known, and so the additional length of the cable required to re-route it around the rMCZ is assumed to be equal to half the circumference of the rMCZ. No inter-array cabling is anticipated to be required in this rMCZ as no existing or planned wind farm developments directly overlap the rMCZ. These costs are included in Scenario 2 to reflect uncertainty over whether this additional mitigation will be required. However, JNCC and Natural England (pers. comm., 2012)

Table 2b. Renewable energy:	**rMCZ Reference Area S, North St George's Channel (2)**
	state that the likelihood of this cost occurring is very low. Further details are provided in Annex H14. The impacts that are assessed in both scenarios are based on JNCC and Natural England's advice on the mitigation that could be required. An alternative assessment of cost has also been provided by Centrica which makes assumptions that differ to those provided by JNCC and Natural England. ***Comments from Centrica:*** Centrica is concerned that the designation of rMCZ 3 could incur significant additional costs for its future developments. It is concerned that additional surveys, impact analysis and data monitoring could be required for the Environmental Impact Assessment (EIA). It is also concerned that the additional data and analysis would incur additional time to the Marine Management Organisation, the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the Infrastructure Planning Commission to consider the licence applications and that these additional costs could be invoiced to Centrica, in particular if there was a need to commission expert advice. In terms of additional mitigation costs, Centrica anticipates that there could be additional installation costs for cables that pass through an MCZ. Centrica anticipates that there could be additional vessels restrictions in MCZs including seasonal closures and restricted working times (due to noise and disturbance etc.) during construction and during operation and maintenance. It is concerned that there could be knock-on delays to modification applications to the National Grid if the EIA is delayed or requires extra surveys, modelling or assessment. Centrica also anticipates additional costs for the EIA that supports the re-powering and decommissioning plans, although it is acknowledged that this cost would take place outside the IA 20-year period of analysis. (Centrica, pers. comm., 2011). Centrica has requested that this site-specific cost is kept confidential. However, it is included in national and regional summaries of impact on the sector in the Evidence Base and Annex F respectively.

Table 2c. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ Reference Area S, North St George's Channel (2)**
Oil and gas related activities (including carbon capture and storage) It is unlikely that any oil and gas (including carbon capture and storage) infrastructure will be proposed in future in this rMCZ Reference Area due to the location and size of the rMCZ reference area (DECC, pers. comm., 2012)	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area S, North St George's Channel (2)**
Recreation and shipping.	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area S, North St George's Channel (2)**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).Fishing vessels are known to use bottom trawls, dredges, pots and traps, mid-water trawls, hooks and lines, and nets in the site. See Table 2 for more detail. Subtidal gravel and sand sediments are important as nursery areas for fish such as plaice (*Pleuronectes platessa)* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)).. Offshore sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2011) in Fletcher and others (2012). Biogenic reefs provide habitat for shellfish and fish, such as temperate rocky reef fish (Gunderson & Vetter (2006) in Fletcher and others (2012)). Reefs support crevice-dwelling animals such as large crabs and lobsters as well as the queen scallop *Aequipecten opercularis* (Hill and others (1998) and references therein; in Fletcher and others (2012)). They can also support the spat of bivalves such as scallops (OSPAR (2008) in Fletcher and others (2012)). Scallop and queen scallop dredging is carried out in locations of *M. modiolus* reefs (Holt and others (1998) in Fletcher and others (2012)), for example off the south-east coast of the Isle of Man. It is also likely that young Atlantic cod *Gadus morhua* seek *M. modiolus* beds for food and refuge (Hiscock & Marshall (2006) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site (that provide this service) when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, there will be no benefits to fisheries. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services	**rMCZ Reference Area S, North St George's Channel (2)**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Subtidal biogenic reefs play a major role in the global carbon cycle and are a major store of carbon (Fletcher and others (2012)). They play a key role in organic matter processing and nutrient cycling at the water–sediment interface (Holt and others (1998); Mermillod-Blondin (2003); both in Fletcher and others (2012)). Subtidal biogenic reefs also filter large volumes of water (Dubois, 2006) and this helps to purify water of contaminants. These living reefs are important as they fix and process nutrients from the sea water into the benthic environment. Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Horse mussel beds are extremely rich; for example 270 invertebrate species were found with horse mussel beds off the north-east of the Isle of Man (OSPAR (2008) in Fletcher and others (2012)). Because of the abundant epifauna and infauna, horse mussel beds have been considered to support one of the most diverse sublittoral communities in north-west Europe (Holt and others (1998) in Fletcher and others (2012)). Threads secreted by horse mussel beds have an important stabilising effect on the sea bed, binding together living matter with dead shell and sediments (Fletcher and others (2012)). Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). At depth, polychaetes, sponges, cnidarians and bryozoans were found to form a diverse	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. It is assumed that the site will be closed to all commercial fisheries and/or mid-water trawling. Therefore, species richness could increase. In particular species such as seapens and brittle star may benefit as they have been found to be impacted on by bottom trawling (Greathead and others (2005); Adey and others (2006); Adey (2007); Kaiser and others (2000) in Blythe and others (2002)). Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area S, North St George's Channel (2)**
community within circalittoral rock (Cebrian (2000) in Fletcher and others (2012)). Species include starfish, sea urchins, algae and large ascidians (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). ***Natural hazard protection*** Biogenic reefs help to reduce wave energy and so help to protect coastlines from erosion (McManus (2001), Riding (2002); both in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**rMCZ Reference Area S, North St George's Channel (2)**
Baseline	**Beneficial impact**	
Numerous surveys have been undertaken in the site associated with the proposed Round 3 (Zone 9) wind farm area of search and various cable developments. This comprises benthic surveys, fisheries surveys, acoustic surveys etc. Rees (2005; in ISCZ, 2011) has studied the horse mussel beds in this part of the Irish Sea. The Joint Nature Conservation Committee (JNCC) (2011; in ISCZ, 2011) has researched the Croker Carbonate Slabs in the site which are a recommended Special Area of Conservation (SAC).	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ Reference Area S, North St George's Channel (2)**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area T, Cunning Point

Site area (km^2): 0.46

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts	**rMCZ Reference Area T, Cunning Point**
1a. Ecological description	

This site is located at Cunning Point on the Cumbrian coast Cunning Point is an excellent example of a true rocky shore and exhibits an interesting array of habitats from huge wave-cut platforms to mini-cliffs, arches, surge gullies and large boulders (Lancaster (2010) in ISCZ, 2011). Cunning Point is also recognised as a Regionally Important Geological and Geomorphological Site (RIGS) and has some of the best examples of moderate energy intertidal rock habitats within the Irish Sea Conservation Zones Project Area.

The complex structure of the rocky habitat at Cunning Point supports a diverse community of flora and fauna. This bedrock is present along most of the length of the proposed site from the mid-shore to (at least) mean low water. These include extensive horizontal beds to the south and 2–3-metre-high vertical and overhanging rock faces and gullies at and around Cunning Point. Rock pools are common, with a good mix of sizes and depths. Extensive areas of boulders and cobbles on bedrock and mobile shingle are present on mid- and lower shores, with signs of abrasion to adjacent areas. The rock pools appear to support typical species (Lumb, pers. comm., 2011). At the extreme low water mark there is a kelp zone which is dominated by oarweed *Laminaria digitata* and supports the associated plant and animal community common to the kelp patches. Barnacles, tiny seed mussels and newly established red seaweeds such as dulse *Palmaria palmata*, Irish moss *Chondrus crispus* and false Irish moss *Mastocarpus stallatus* dominate the lower shore wave-cut platforms. Toothed wracks *Fucus seratus* are also common but only on the boulders found at the base of the wave-cut platforms. Moving higher up the wave-cut platform, the vertices are colonised by barnacles, seed mussels and algae tucked into crevices. The top of the platforms are characterised by a variety of seaweeds (Lancaster (2010) in ISCZ, 2011). Mid-shore, communities of barnacles *Balanus* and *Chthamalus* spp. and limpets *Patella vulgata* were found, changing to seaweeds, namely bladder wrack *Fucus vesiculosus* and egg wrack *Ascophyllum nodosum* beneath which barnacles and limpets can be found, including encrusting red algae. Deep rock pools exhibited toothed wrack *Fucus seratus* and sugar kelp *Laminaria saccharina*. Rock prawns *Palaemon seratus* and shannies *Lipophrys pholis* also frequent the pools (Lancaster (2010) in ISCZ, 2011).

The large numbers of sand eels *Ammodytes* spp. present in sandy sediment attract sea birds such as puffins, razorbills, guillemots and terns. This habitat type is an important area for crabs and other epifauna, in particular echinoderms. Hermit crabs *Pagurus bernhardus*, the swimming crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* feed on prey in this habitat (Jones, Hiscock & Connor (2000) in ISCZ, 2011).

Within the Irish Sea Conservation Zones Project Area there are very few natural rock exposures; much of the limited hard coastline has been heavily modified by the dumping of waste from the iron, steel and coal industries. The proposed site contains some of the best examples of moderate energy intertidal rock habitats. This is confirmed by annual coastal surveys that have been undertaken for the Cumbria Sea Fisheries Committee (now the North Western Inshore Fisheries and Conservation Authority (NWIFCA)) since 1993 (ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ				
Feature	**Area of feature (km^2)**	**No. of point records**	**Baseline**	**Impact of MCZ**
Broad-scale Habitats				
Moderate Energy Intertidal Rock	0.08	-	Unfavourable condition	Recover to reference condition
Subtidal Mud	0.38	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Subtidal Sands and Gravels	0.46	7	Unfavourable condition	Recover to reference condition
1c. Contribution to an ecologically coherent network				
To be completed. Awaiting NE/JNCC.				

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries	**rMCZ Reference Area T, Cunning Point**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of entire rMCZ Reference Area to all commercial fisheries. This includes the hand collection of intertidal flora and fauna.	
Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), at least five UK vessels are known to fish in the site using bottom trawls, nets, pots and traps and hand lines (ISCZ, 2010). All but one of the vessels is less than 15 metres in length. The vessels target sole, plaice, prawn, pollack, bass, cod, crab and lobster. These vessels are associated with the home ports of Fleetwood, Maryport, Whitehaven and Newlyn (ISCZ, 2010). Fewer than 5 intertidal fishers are known to hand-pick for cockles and mussels in the site (ISCZ, 2010). Vessel Monitoring System (VMS) data does not provide any evidence of activity by over 15 metre UK vessels in the site. The estimated total value of UK landings from the site is £0.009m/yr. This is provided for each affected gear type below.	
Baseline description of UK commercial fisheries	**Costs of impact of rMCZ on UK commercial fisheries**
Bottom trawls: Fewer than 5 UK vessels are known to bottom trawl in the site, targeting prawn, pollack, plaice and sole throughout the year. These vessels are associated with the home ports of Fleetwood, Maryport and Whitehaven (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* | Scenario 1 Value of landings affected | <0.001 North Western Inshore Fisheries and Conservation Authority (NWIFCA) and Whitehaven fishermen's association do not feel that the bottom trawling fleet will be significantly impacted by rMCZ Reference Area T. There is little evidence, if any of bottom trawling within the site (NWIFCA & Cumbria Fisheries, 2011).

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th>rMCZ Reference Area T, Cunning Point</th></tr>
<tr><td colspan="2">Pots and traps: Fewer than 5 UK vessels are known to use pots and traps in the site, targeting crab and lobster throughout the year. These vessels are associated with the home ports of Newlyn and Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
Vessels using pots and traps operate in the rMCZ Reference Area for 6 to 8 months of the year (February to October). The pots are set by a vessel and are lifted daily or every few days. Two commercial vessels are known to be active in the site. Other hobby/non-commercial vessels are also likely to operate there. There are approximately 150 pots in the site at any one time. The vessels that work the area work up and down the coast, each having anywhere from 600 to1,200 pots out to 1 mile offshore (up to 4 miles offshore in places). This area is very productive for lobster, less so for crab. There is potential for growth in this fishery in coming years along the Cumbrian coast (NWIFCA & Cumbria Fisheries, 2011; ISCZ liaison officer, pers. comm., 2011).
The estimated value of landings from the site is £0.002m/yr, based on the stated earnings from the site of one potting vessel (NWIFCA, pers. comm., 2011).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.002</td></tr></table>NWIFCA and Whitehaven fishermen's association have identified several vessels who fish in the rMCZ. One vessel skipper working the site estimates a loss of earnings of at least £200 per month (£2,400/yr) due to the rMCZ designation. The vessels that fish in the site are worried about a loss of income that could arise if the rMCZ Reference Area is designated (NWIFCA & Cumbria Fisheries, 2011). Though the impact on the UK economy is not likely to be significant, the impacts on individual fishers could be significant.</td></tr>
<tr><td colspan="2">Hooks and lines: Fewer than 5 UK vessels are known to use hand lines in the site, to target bass, plaice and cod throughout the year. The vessels are associated with the home port of Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using hooks and lines will be significantly impacted by rMCZ Reference Area T. There is little evidence, if any of vessels using hooks and lines within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td colspan="2">Nets: Fewer than 5 UK vessels are known to use gill nets in the site, targeting bass, plaice and cod throughout the year. The vessels are associated with the home port of Maryport (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using nets will be significantly impacted by rMCZ Reference Area T. There is little evidence, if any of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td colspan="2">Collection by hand: Fewer than 5 intertidal fishers are known to be active in the site, collecting cockles by hand from September to April (ISCZ, 2010).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr></table></td></tr>
</table>

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries</th><th>rMCZ Reference Area T, Cunning Point</th></tr>
<tr><td colspan="2">The estimated value of landings from the site is £0.006m/yr (MCZ Fisheries Value Model).</td><td><table><tr><td>Value of landings affected</td><td>0.006</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel fishers gathering by hand will be significantly impacted by rMCZ Reference Area T. There is little evidence of hand gathering taking place within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><th colspan="3">Total direct impact on UK commercial fisheries</th></tr>
<tr><td colspan="2"></td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.009</td></tr><tr><td>GVA affected</td><td>0.004</td></tr></table>At least five UK vessels (bottom trawls, potters and gill netters) are known to fish in the site. Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario (ISCZ, 2010):
Scenario 1: 5</td></tr>
<tr><th colspan="2">Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td colspan="2">VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).</td><td>None.</td></tr>
</table>

<table>
<tr><th colspan="2">Table 2b. Flood and coastal erosion risk management (coastal defence)</th><th>rMCZ Reference Area T, Cunning Point</th></tr>
<tr><td colspan="3">Source of costs of the rMCZ
Management scenario 1: Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline).</td></tr>
<tr><th colspan="2">Baseline description of activity</th><th>Costs of impact of rMCZ on the sector</th></tr>
<tr><td colspan="2">The Shoreline Management Plan (SMP) policy unit (0–20 yrs) that is of relevance to consider here is: 2.4: Hold the line (by maintaining/upgrading railway defences) (Natural England & Environment Agency, pers. comm., 2012).</td><td>It is anticipated that no additional mitigation of impacts will be required within the rMCZ Reference Area. Access vehicles (for maintenance works to the railway which is located outside the rMCZ) are likely to be required to re-route around the rMCZ; however, no extra mitigation of impact requirements are anticipated (Natural England & Environment Agency, pers. comm., 2012). As a result of the rMCZ, it is anticipated that additional costs will be incurred in assessing environmental impacts in support of future licence applications for Flood and Coastal Erosion Risk Management (FCERM) schemes. For each licence application these costs are expected to arise as a result of approximately 0.5–1 day of additional work, in most cases, although there may be cases where further additional consultant time is needed (Environment Agency, pers. comm., 2012). It has not been possible to obtain information on the likely number of licence</td></tr>
</table>

Table 2b. Flood and coastal erosion risk management (coastal defence)	**rMCZ Reference Area T, Cunning Point**
Source of costs of the rMCZ	
Management scenario 1: Increase in costs of assessing environmental impacts for future licence applications (it is not anticipated that any additional mitigation of impacts on features protected by the rMCZ will be needed relative to the mitigation provided in the baseline).	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
	applications that will be made over the 20 year period of the IA or estimates of the potential increase in costs.

Table 2c. Ports, harbours, shipping and disposal sites	**rMCZ Reference Area T, Cunning Point**
Source of costs of the rMCZ	
Management scenario 1: Not applicable to site.	
Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Port development: The ports of Workington and Whitehaven are located within 5km of this rMCZ. No port developments are known to be planned within the 20-year period of the Impact Assessment (IA).	

£m/yr	Scenario 1	Scenario 2
Cost to the operator	0.000	<0.001*

* This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information.

Scenario 1: Not applicable.

Scenario 2: Future licence applications for port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2d. Recreation	**rMCZ Reference Area T, Cunning Point**
Source of costs of the rMCZ	
Management scenario 1: Closure of angling in the entire site. Prohibition of extraction of species by divers.	

Baseline description of activity	Costs of rMCZ on the sector
Angling: Shore and boat angling are known to take place in the area, targeting cod, dogfish, bass and whitefish. It is estimated that at least 66 anglers visit the site each year making repeat visits. This may not necessarily take place within the rMCZ though. (ISCZ, 2010). This is likely to be an overestimate as the numbers collected through interviews with recreational users were for areas larger than this site. ***Diving:*** Stakeholders have indicated that, on average, general/scenic diving trips takes place in the area in two days of every month from April to September. There are approximately six people on every trip. This may not necessarily take place within the rMCZ though. (ISCZ, 2010).	***Angling:*** Potentially, at least 66 anglers could be affected by the closure to angling. It is anticipated that they will respond by fishing at alternative coastal locations in the north-west of England (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). This could impact on anglers' travel costs. However, no evidence of impact was identified through the ISCZ Project's consultation with anglers. ***Diving:*** It is anticipated that prohibition of removal of material by divers will have a negligible impact on their diving experience. No impacts, including impacts of the closure to anchoring (except in emergency) were identified through the ISCZ Project's consultation with local diving clubs.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	rMCZ Reference Area T, Cunning Point
Flood and coastal erosion risk management (coastal defence), water pollution from activities on land; other recreational activities (including sailing). The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area T, Cunning Point**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)).There is very little commercial fishing in the site. There are some vessels using bottom trawls, nets, pots and traps and hand lines but very little of this activity is likely to take place this close to shore (the extent of the site). Intertidal fishers also collect shellfish by hand in the site. See Table 2 for more detail. Subtidal gravel and sand sediments are important as nursery areas for fish such as plaice (*Pleuronectes platessa)* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Intertidal rock habitats are important sources of larval plankton upon which commercially important fish species feed, including mussels and larval fish of plaice and mackerel (Fletcher and others (2012)). The benthic (bottom dwelling) organisms of this habitat form an important part of the food chain and transfer organic carbon back into the pelagic (open water) realm (Snelgrove (1999) in Fletcher and others (2012)). *Nephrops norvegicus* is known to be eaten by a variety of bottom-feeding fish including haddock, cod, skate and dogfish (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Burrowing shrimps and echiuran worms are also found in the stomachs of bottom feeding fish (Hill (2008) in Fletcher and others (2012)).The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when not in reference condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. Benefits defined here are not net of potential costs of the rMCZ and off-site impacts of displaced effort. As the rMCZ is small it is unclear whether it would have any impact on stocks of mobile commercial finfish species.	Anticipated direction of change: ⇧ Confidence: Low

Table 4b. Regulating services	**rMCZ Reference Area T, Cunning Point**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Burrowing animals (including *Nephrops norvegicus*) are important as they disturb and mix sediments by burrowing, boring or ingesting. For example, they ingest and excrete the particles present within sea water to form their burrow tubes; this provides stability to	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of	Anticipated direction of change: ⇧ Confidence:

Table 4b. Regulating services	**rMCZ Reference Area T, Cunning Point**	
the sediment substrate (Kogure & Wada (2005) in Fletcher and others (2012)). The burrowing activity also helps to return mineralised nutrients to the overlying sea water at a faster rate than diffusion alone (Paramour & Frid (2006) in Fletcher and others (2012)). Larger burrowing animals recycle more nutrients than smaller individuals and to a greater depth (Paramour & Frid (2006) in Fletcher and others (2012)). The burrowing activity is also important for oxygenating the upper layers of sediment (Hiscock & Marshall (2006) in Fletcher and others (2012)). Other studies carried out in the Irish Sea around Sellafield have suggested that muddy subtidal sediment habitats help to absorb radionuclides released from the Sellafield plant (Finnegan and others (2009) in Fletcher and others (2012)). Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). Similarly, nitrification occurring in marine sediments is an important component of the global nitrogen cycle and may play a role in regulating oceanic nitrogen (Burdige (2006) in Fletcher and others (2012)). Nitrate is removed from coastal waters by microbial biofilm on intertidal rock (Magalhaes (2003) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Subtidal sediment (including sand) found in sheltered or deeper water is one of the most diverse habitats with bivalves, polychaetes, amphipods, sessile and mobile epifauna (UK Biodiversity Partnership (2010) in Fletcher and others (2012)) and also a high abundance of starfish and brittlestar (Fletcher and others (2012)). Intertidal rock is generally of high biodiversity (Hill (1998) in Fletcher and others (2012)). On exposed rock, mussels, limpets, barnacles, fucoids and red seaweed are found. Cracks, crevices and rock pools increase species richness and abundance (Baker (1987) in Fletcher and others (2012)). During the summer, ephemeral green and red seaweeds dominate intertidal rock (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Due to the depth of the water column and low-energy regime, deep water mud habitats are very stable and often highly diverse (Hiscock & Marshall (2006) in Fletcher and others (2012)). Fauna associated with these habitats include seapens and burrowing	future degradation from pressures caused by human activities.	Moderate

Table 4b. Regulating services		**rMCZ Reference Area T, Cunning Point**
crustaceans, starfish, hermit crabs, harbour crabs, polchaetes and bivalves (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). In general, evidence suggests that the diversity of soft sediments increases from shallow areas to the deep sea (Paramour & Frid (2006) in Fletcher and others (2012)). ***Natural hazard protection:*** Intertidal rock protects the coastline from erosion by reducing the wave energy that reaches the shore (Anthony, 2008) (Hill (1998) in Fletcher and others (2012)). The presence of boulders in the intertidal area can help reduce coastline exposure to wave energy (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Research and education		**rMCZ Reference Area T, Cunning Point**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Intertidal rocky shores are a classic focus for research and there is a wealth of historical data regarding many aspects of ecology (Connell (1961); Paine (1969) in Fletcher and others (2012)). Such baseline data are extremely useful for exploring the impacts of environmental change (Hawkins (2009) in Fletcher and others (2012)). Rocky intertidal zones have been an active area of research because communities are well defined and accessible, and so can be easily and efficiently surveyed (Hill (1998) in Fletcher and others (2012)).	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values		**rMCZ Reference Area T, Cunning Point**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The	Anticipated direction of change: ⇧

Table 4d. Non-use and option values		**rMCZ Reference Area T, Cunning Point**
	rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation.	Confidence: Moderate

Recommended Conservation Zone (rMCZ) Reference Area W, Barrow South — Site area (km^2): 0.46

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area W, Barrow South**

1a. Ecological description

This site is situated south of Walney Island and east of Roa Island, in an area known as Westfield. Two species of eelgrass *Zostera* spp. are found within the site, namely the dwarf eelgrass *Zostera noltii* and the narrow leaf eelgrass *Zostera angustifolia* (English Nature (2000) in ISCZ, 2011). This is a particularly important site as the eelgrass beds found in this region are the only known location of this habitat in the Irish Sea Conservation Zones Project Area and in the north-west of England (English Nature (2000) in ISCZ, 2011).Recommended MCZ Reference Area W falls within the Walney Island and Piel Flats Site of Special Scientific Interest (SSSI) and is also within the Morecambe Bay Special Area of Conservation (SAC).

Eelgrass beds are ecologically important habitats and play a number of important roles in shallow water areas. Their extensive horizontal root networks (rhizomes) have a stabilising effect on coastal sediments. They bind and consolidate sediments, reduce susceptibility to erosion and therefore reduce sediment transport by currents. Further to this, the leaves promote settlement of sediment (Davidson and Hughes (1998) in ISCZ, 2011). Seagrass beds are known to provide shelter to post-larvae and juveniles of some commercial fish species. They are highly productive habitats and their root systems help to aerate the upper layers of sediment that can promote inhabitation by some burrowing animals including bivalves and annelid worms (Davidson and Hughes (1998) in ISCZ, 2011).

Connor and others (1997, in ISCZ, 2011) described the typical infaunal community (creatures living within the sediment) associated with the broad-scale habitat of intertidal mud as being characterised by polychaetes such as the bristle worm *Pygospio elegans*, lugworm *Arenicola marina* and mud shrimps *Corophium volutator*. Bivalves such as the common cockle *Cerastoderma edule*, Baltic tellin *Macoma balthica* and peppery furrow shell *Scrobicularia plana* are also present. Typically, an epifaunal community (creatures that dwell on the sediment) includes the mud snail or laver spire shell *Hydrobia ulvae*, shore crabs *Carcinus maenas* and the green alga *Ulva* sp. Such diverse communities have been recorded in the soft sediment invertebrate surveys conducted by the Natural History Museum within the Westfield area and Recommended MCZ Reference Area W (Evans and others (2008) in ISCZ, 2011). Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Intertidal Mud	0.07	-	Unfavourable condition	Recover to reference condition
Intertidal sediments dominated by aquatic angiosperms	0.35	-	Unfavourable condition	Recover to reference condition
Habitats of Conservation Importance				
Seagrass Beds	-	-	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network
To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries — **rMCZ Reference Area W, Barrow South**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries. This includes hand collection of intertidal flora and fauna.

Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), fewer than 5 UK vessels have stated that they use bottom trawls in the site (ISCZ, 2010). However, this is likely to be incorrect and due to a mapping resolution error (liaison officer, pers. comm., 2011). Due to the size, location and intertidal nature of this site, it is highly unlikely that any commercial vessel fishing takes place in the site (liaison officer, pers. comm., 2011). Six intertidal fishers have indicated that they work in the site using nets and hand-picking (ISCZ, 2010). They target cockle, mussel, salmon, shrimp, mullet, bass, plaice and flounder throughout the year (ISCZ, 2010). Vessel Monitoring System (VMS) data do not provide any evidence of activity by over 15 metre UK vessels in the site. The estimated total value of UK landings from the site is £0.020m/yr (excluding the value of collections by hand; landings from this gear type are not included in the MCZ Fisheries Model as these data are not officially collected). This is provided for each affected gear type below.

Baseline description of UK commercial fisheries	Costs of impact of rMCZ on UK commercial fisheries
Bottom trawls: Due to the size, location and intertidal nature of this site, it is highly unlikely that any bottom trawling takes place there. However, interviews with fishers indicate that fewer than 5 UK vessels bottom trawl in the site, targeting shrimp, plaice and sole (ISCZ, 2010). However, this is likely to be incorrect and due to a mapping resolution error (liaison officer knowledge). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1 Value of landings affected — <0.001 North Western Inshore Fisheries and Conservation Authority (NWIFCA) and Whitehaven fishermen's association do not feel that vessels using bottom trawls will be significantly impacted by rMCZ Reference Area W. There is little evidence of vessels using bottom trawls within the site (NWIFCA & Cumbria Fisheries, 2011).
Nets: Due to the size, location and intertidal nature of this site, it is highly unlikely that any netting takes place there. However, interviews with fishers have indicated that fewer than 5 UK vessels use nets in the site to target shrimp, bass, plaice, flounder and mullet (ISCZ, 2010). However, this is likely to be incorrect and due to a mapping resolution error (liaison officer knowledge). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a). The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).	The annual value of UK landings affected is estimated to fall within the following range: *£m/yr* — Scenario 1 Value of landings affected — <0.001 NWIFCA and Whitehaven fishermen's association do not feel that vessels using nets will be significantly impacted by rMCZ Reference Area W. There is little evidence of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011).

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ Reference Area W, Barrow South</th></tr>
<tr><td>Collection by hand: Six intertidal fishers have indicated that they work in the site using nets and hand-picking (ISCZ, 2010). They target cockle, mussel, salmon, shrimp, mullet, bass, plaice and flounder throughout the year (ISCZ, 2010).
The estimated value of landings from the site is £0.020m/yr (ISCZ, 2010)
This will be an overestimate of the value of collection by hand fisheries in the site because this figure is based on the stated earnings of 6 fishers for fishing grounds that cover an area greater in size than that covered by the rMCZ. Some of the stated earnings of fishers for this rMCZ will represent earnings from nearby Morecambe Bay (an area much greater than the area represented by this rMCZ).</td><td>The annual value of UK landings affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.020</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that fishers gathering by hand will be significantly impacted by rMCZ Reference Area W. There is little evidence of fishers gathering by hand within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><th colspan="2">Total direct impact on UK commercial fisheries</th></tr>
<tr><td>Due to the size, location and intertidal nature of this site, it is highly unlikely that any commercial fishing takes place there. However, at least 5 UK vessels (bottom trawls and nets) and at least 16 intertidal fishers have indicated that they fish in the area (ISCZ, 2010). However, the number of vessels is likely to be incorrect and due to a mapping resolution error (based on liaison officer knowledge of the site).</td><td>The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:
<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td>0.020</td></tr><tr><td>GVA affected</td><td>0.009</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that fishers will be significantly impacted by rMCZ Reference Area W. There is little evidence, if any of fishing taking place within the site (NWIFCA & Cumbria Fisheries, 2011). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario (ISCZ, 2010):
Scenario 1: < 5</td></tr>
<tr><th>Baseline description of non-UK fisheries</th><th>Costs of impact of rMCZ on non-UK commercial fisheries</th></tr>
<tr><td>VMS data provides no evidence of fishing by over 15 metre non-UK vessels in the site (MMO, 2011a).</td><td>None.</td></tr>
</table>

Table 2b. Ports, harbours, shipping and disposal sites **rMCZ Reference Area W, Barrow South**

Source of costs of the rMCZ

Management scenario 1: Not applicable to this site.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. Additional costs incurred in updating the existing Maintenance Dredging Protocol (MDP). It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Navigational dredge areas: The rMCZ is approximately 2km east of the main navigation channel into the port of Barrow. Maintenance dredging in the navigation channel takes place in order to maintain navigable depth, particularly to facilitate the transit of nuclear submarines. It is assumed that each dredge area's marine licence is renewed once every three years and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. As navigational dredging in this area is covered by an existing MDP, it is assumed that the assessment of environmental impact is not changed over the 20 year period of the IA. ***Port development:*** The port of Barrow is located within 5km of this rMCZ. No port developments are known to be planned within the 20-year period of the Impact Assessment (IA).	<table><tr><td>*£m/yr*</td><td>Scenario 1</td><td>Scenario 2</td></tr><tr><td>Cost to the operator</td><td>0.000</td><td>0.005*</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. This figure does not include the cost to include MCZ features in a MDP as it is not possible to break this down to each site. Instead it assumes that each dredge area's marine licence is renewed once every three years and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. The Scenario 2 cost is likely to be smaller as the navigational dredging in the vicinity of this rMCZ is covered by a MDP. ***Scenario 1*:** Not applicable. ***Scenario 2*:** Future licence applications for navigational dredging and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. An additional cost will arise to update the existing MDP to consider the potential effects of activities on the features protected by the rMCZ. The anticipated additional cost in the MDPs is estimated to be a one-off cost of £8438. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2c. Recreation **rMCZ Reference Area W, Barrow South**

Source of costs of the rMCZ

Management scenario 1: Closure of angling in the entire site. Prohibition of quad biking in the site.

Baseline description of activity	**Costs of impact of rMCZ on the sector**

Table 2c. Recreation	**rMCZ Reference Area W, Barrow South**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling in the entire site. Prohibition of quad biking in the site.	
Baseline description of activity	**Costs of impact of rMCZ on the sector**
Angling: Shore and boat angling are known to take place in the area, targeting pollack, tope, codling, plaice, bass and mackerel. It is estimated that at least 40 anglers visit the site each year making repeat visits. This may not necessarily take place within the rMCZ though. (ISCZ, 2010). ***Quad biking:*** Quad biking is also reported to take place in the site. No further information is available (ISCZ liaison officer pers. comm., 2011).	***Angling:*** At least 40 anglers could be affected by the closure to angling, though this is likely to be an overestimate. It is anticipated that they will respond by fishing at alternative coastal locations in the north-west of England (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). This could impact on anglers' travel costs. However, no evidence of impact was identified through the ISCZ Project's consultation with anglers. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant. ***Quad biking:*** No evidence of impact is apparent. Though the impact on the UK economy is not likely to be significant, the impacts on individual quad bikers could be significant.

Table 2d. Other impacts that are assessed for the suite of MCZs and not for this site alone	**rMCZ Reference Area W, Barrow South**
Oil and gas related activities (including carbon capture and storage) It is unlikely that any oil and gas (including carbon capture and storage) infrastructure will be proposed in future in this rMCZ Reference Area due to the location and size of the rMCZ reference area (DECC, pers. comm., 2012)	

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area W, Barrow South**
Flood and coastal erosion risk management (coastal defence), water pollution from activities on land; other recreational activities (including dog walking, walkers and bird watching). The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption	**rMCZ Reference Area W, Barrow South**	
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). There is very little commercial fishing in the site. Due to the size, location and intertidal nature of this site, it is highly unlikely that any commercial vessel fishing takes place (ISCZ liaison officer, pers. comm., 2011). Six intertidal fishers have indicated that they work in the site using nets and hand-picking (ISCZ, 2010). They target cockles, mussels, salmon, shrimp, mullet, bass, plaice and flounder throughout the year (ISCZ, 2010). See Table 2 for more detail. Intertidal mud is an important area for juvenile fish such as plaice (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). It also supports sole, dab and flounder which feed on polychaetes, young bivalves and siphons (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Intertidal mud provides habitat for fish of commercial importance (Humphreys and others (2007) in Fletcher and others (2012)). A higher abundance and production of the following species were found in areas of seagrass compared with bare sandflats: juvenile shore crabs *Carcinus maenas*., brown shrimps *Crangon crangon*. and common gobies *Pomatoschistus microps (*Krøyer and others (2005) in Fletcher and others (2012)). It has also been noted that seagrass serves as a nursery site for juvenile crabs and fish (Massa and others (2009) in Fletcher and others (2012)). Cuttlefish are associated with seagrass habitat in the UK (Connor and others (2004) in Fletcher and others (2012)). For example, a cuttle fishery operates in the vicinity of the Cowes outer harbour seagrass bed from April to August (ABPmer (2009) in Fletcher and others (2012)). Cockle harvesting by both hand-picking and suction dredging has been undertaken in the vicinity of seagrass beds in the UK. Sweden and others (2007, in Fletcher and others (2012)) state that coastal habitats, including seagrass, are key supporting habitats for fish species at key stages in their life cycle. The loss of seagrass is associated with sudden and significant decreases in juvenile cod (Pihl and others (2006) in Fletcher and others (2012)). Seagrass also supports lugworm and and catworm, which in some areas of the UK are harvested commercially for bait (South East of England Biodiversity Strategy (2008) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when not in reference condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance, size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. As the rMCZ is small it is unclear whether it would have any impact on stocks of mobile commercial finfish species.	Anticipated direction of change: ⇧ Confidence: Low

Table 4b. Regulating services	**rMCZ Reference Area W, Barrow South**	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). A considerable quantity of cadmium is stored in sediment by cord grass *Spartina anglica* growing in intertidal mud (Hubner and others (2010) in Fletcher and others (2012)). Seagrass beds can also help to absorb some metals (chromium, nickel, lead, iron and copper) (Rigollet and others (1998) in Fletcher and others (2012)). Seagrasses are able to take up inorganic nutrients to reduce the risk of eutrophication, which therefore assists water quality. They also help water quality by trapping particles (Teradoos & Borum (2004) in Fletcher and others (2012)). Waycotta and others (2009, in Fletcher and others (2012)) estimated the value of the nutrient cycling provided by seagrass meadows (presumably at a global level) at $US1.9 trillion per year. Intertidal mudflats store carbon at similar levels to freshwater wetlands/peatland areas (Andrews and others (2006); Chmura and others (2003) in Fletcher and others (2012)). As with other intertidal areas, areas dominated by aquatic angiosperms are significant carbon sinks, providing carbon storage at approximately ten times the rate observed in temperate forests and 50 times the rate observed in tropical forests per unit area (IUCN (2009) in Fletcher and others (2012)). These areas therefore contribute to the storage of carbon and thus have an important role within the carbon cycle (Ronnback and others (2007) in Fletcher and others (2012)). ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. Seagrass beds increase habitat complexity and provide substrate for other organisms to attach. This helps them to increase species richness and/or abundance (Edgar and others (1994); Heck and others (1995); Bostrom & Bonsdorff (1997) in Fletcher and others (2012)). Hirst and Attrill (2008, in Fletcher and others (2012)) showed that even small patches	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities.	Anticipated direction of change:  Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area W, Barrow South**
of seagrass in Torbay, Devon, supported higher levels of biodiversity than surrounding bare sand, indicating that just the presence of seagrass, irrespective of the size of the patch, influenced biodiversity. Seagrass species can also be very diverse. Hughes & Stachowicz (2004, in Fletcher and others (2012)) concluded that genetic diversity may contribute to the resistance of communities to various disturbances and hence provide 'biological insurance' against environmental change. The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition. ***Natural hazard protection:*** Intertidal mud areas and seagrass beds help protect coastal margins from erosion by dissipating wave and current energy (Bale and others (2007a); Kirby (2008); Ronnback and others (2007); Fonseca and others (1982) in Fletcher and others (2012)). The features in this site provide important coastal protection to the Barrow gas terminals.		

Table 4c. Recreation		**rMCZ Reference Area W, Barrow South**
Baseline	**Beneficial impact**	
Shore and boat angling are known to take place in the site, targeting pollack, tope, codling, plaice, bass and mackerel. It is estimated that at least 40 anglers visit the site each year (ISCZ, 2010). Quad biking is also reported to take place in the site (ISCZ liaison officer, pers. comm., 2011). Fletcher and others (2011) state that the features to be protected by the rMCZ can contribute to the delivery of recreation and tourism services. In particular, intertidal mud is an important feeding ground for wading birds all year round (Bale and others (2007) in Fletcher and others (2012)) and migrating birds such as Brent geese, shelducks, pintails, oystercatchers, ringed plovers, grey plovers, bar-tailed and black-tailed godwits, curlews, redshanks, knots, dunlins and sanderlings (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Seagrass provides food for overwintering wildfowl, particularly Brent geese and wigeons (Davison & Hughes (1998); Tubbs (1999); Percival & Evans (2008) in Fletcher and others (2012)). Small crustaceans and crabs consume seagrass tissue (Hemminga & Duarte (2000) in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be recovered to favourable condition. Due to the ecological services of features to be recovered in the site, MCZ designation may lead to an increase, in time, of anglers and bird watchers to the site, which may benefit the local economy. Various studies demonstrate the local economic value of sea angling (Scottish Government, 2009; Invest in Fish South West, 2005); however, it has not been possible to quantify the potential impact for this rMCZ. Sea birds are known to attract visitors, which in turn generates local economic value. A study of four Royal Society for the Preservation of Birds (RSPB) marine reserves has highlighted the fact that, on average, an estimated additional income of £300,000 a year can be generated and directly attributed to sea bird watching within a designated nature reserve (RSPB, 2010). On average, this has supported up to the equivalent of an	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4c. Recreation		**rMCZ Reference Area W, Barrow South**
The MCZ features will also provide biological processes that support various fish species which, in turn, will benefit anglers. The baseline quantity and quality of the ecosystem service provided is assumed to be commensurate with that provided by the features of the site when in an unfavourable condition.	additional nine full-tmie jobs at each reserve. While this is the estimated local economic value generated in the absence of MCZs, it emphasises that MCZs could provide ecological benefits for sea birds which in turn could generate local economic value if sea bird numbers increase or are given more protection. However, it is not clear from the research if economic value is likely to increase with sea bird numbers or additional protection. It is, however, likely that a better quality of experience (i.e. more sea birds) would attract more visitors. Regardless, such impacts are likely to be local and represent a redistribution of sea bird watching rather than an overall increase in bird watchers nationally.	

Table 4d. Research and education		**rMCZ Reference Area W, Barrow South**
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. It is known that the seagrass beds have undergone long-term monitoring of condition, in relation to the Barrow gas terminals outfall. They have been extensively studied and monitored by the Natural History Museum. The location of the site has been chosen to include the best example of seagrass beds in the area which are least exposed to public pressure, with strong support from key local stakeholders.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4e. Non-use and option values		**rMCZ Reference Area W, Barrow South**
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation	Anticipated direction of change: ⇧

Table 4e. Non-use and option values		**rMCZ Reference Area W, Barrow South**
	(altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), one 'nominated site' falls within the boundary of rMCZ Reference Area W. The recreational user who nominated the site cited 'spectacular scenery', '[a] wide range of plants and animals', 'ease of access' and 'personal importance' as selection criteria. They also indicated that they perceive the site to 'be under threat', and that protection for the site is needed in order to 'increase the number of fish and shellfish'. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H).	Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area Y, Barrow North — Site area (km^2): 1.24

Table 1. Site-specific benefits arising from the rMCZ (over 2013 to 2032 inclusive)

Table 1. Conservation impacts — **rMCZ Reference Area Y, Barrow North**

1a. Ecological description

This site is proposed for designation for the broad-scale habitat type coastal saltmarshes and saline reedbeds, and their associated habitats of intertidal muds and subtidal coarse sediments. The site lies within the north-eastern portion of Walney Channel, where it enters the Duddon Estuary. The saltmarshes in this area benefit from a number of Marine Protected Areas (MPAs): Morecambe Bay Special Area of Conservation (SAC), under the EC Habitats Directive as an internationally important example of this habitat; Duddon Estuary Special Protection Area (SPA), under the EC Directive on the Conservation of Wild Birds for its nationally and internationally important populations of wintering and passage waders and wildfowl; and the Duddon Estuary Site of Special Scientific Interest (SSSI). The Duddon Estuary is also a site protected under the Ramsar Convention, one of a series of important wetlands around the world. Examples of the wildlife identified in this area are the natterjack toad *Bufo calamita*, a rich grouping of wetland plants and animals, and wintering waders and waterfowl and breeding birds. North Walney is also a designated Natural Nature Reserve.

The saltmarshes within rMCZ Reference Area Y are unusual as they contain areas of ungrazed saltmarsh. Survey work carried out by Natural England (2009, in ISCZ, 2011) showed that the marsh extent appeared to be stable with the natural creeks and pans remaining unaltered in comparison with historical aerial photographs (Evans (2009) in ISCZ, 2011). The site exhibits typical saltmarsh zonation with a relatively species-poor low to mid marsh, and more diverse communities inf the mid to upper marsh. The lower marsh is mostly dominated by sea purslane *Halimione portulacoides*, the mid marsh has abundant lax and common sea lavenders *Limonium humile* and *Limonium vulgare* along with a good range of typical saltmarsh indicator species. There is a small area of upper marsh with common reed *Phragmites* and sea rush *Juncus maritimus* (Evans (2009) in ISCZ, 2011). The area is highly productive and supports important bird populations as well as fish nursery areas. Source: ISCZ (2011).

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Broad-scale Habitats				
Intertidal Mud	0.11	-	Unfavourable condition	Recover to reference condition
Coastal Saltmarshes and Saline Reedbeds	0.73	-	Unfavourable condition	Recover to reference condition
Subtidal Coarse Sediment	0.14	-	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Commercial fisheries — **rMCZ Reference Area Y, Barrow North**

Source of costs of the rMCZ

Management scenario 1: Closure of entire rMCZ to all commercial fisheries. This includes hand collection of intertidal flora and fauna.

<table>
<tr><th colspan="2">Table 2a. Commercial fisheries rMCZ Reference Area Y, Barrow North</th></tr>
<tr><td colspan="2">Summary of all UK commercial fisheries: The site lies completely within the 6 nautical mile (nm) line. A number of commercial fishing restrictions are already in existence (listed in Annex E). Of approximately 700 UK vessels that are known to be active in the Irish Sea Conservation Zones (ISCZ) Project Area (MMO, 2011b; ISCZ, 2010), fewer than 5 UK vessels have indicated that they use bottom trawls and gill nets in the site, targeting cod, bass, mullet, plaice and shrimp (ISCZ, 2010). However, this is likely to be incorrect and due to a mapping resolution error (liaison officer, pers. comm., 2011). Due to the size, location and intertidal nature of this site, it is highly unlikely that any commercial vessel fishing takes place there (ISCZ liaison officer, pers. comm., 2011).Vessel Monitoring System (VMS) data do not provide any evidence of activity by over 15 metre UK vessels in the site. The estimated total value of UK landings from the site is <£0.001m/yr. This is provided for each affected gear type below.</td></tr>
<tr><th>Baseline description of UK commercial fisheries</th><th>Costs of impact of rMCZ on UK commercial fisheries</th></tr>
<tr><td>Bottom trawls: Due to the size, location and intertidal nature of this site, it is highly unlikely that any bottom trawling takes place there. However, interviews with fishers indicate that fewer than 5 UK vessels bottom trawl in the site, targeting plaice (ISCZ, 2010). However, this is likely to be incorrect and due to a mapping resolution error (liaison officer knowledge). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>North Western Inshore Fisheries and Conservation Authority (NWIFCA) and Whitehaven fishermen's association do not feel that vessels using bottom trawls will be significantly impacted by rMCZ Reference Area Y. There is little evidence, if any of vessels using bottom trawls within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Nets: Fewer than 5 UK vessels have indicated that they use gill nets in the site, targeting cod, bass, mullet and shrimp (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table>NWIFCA and Whitehaven fishermen's association do not feel that vessels using nets will be significantly impacted by rMCZ Reference Area Y. There is little evidence, if any of vessels using nets within the site (NWIFCA & Cumbria Fisheries, 2011).</td></tr>
<tr><td>Pots and traps: No UK vessels have indicated that they use pots and traps in the site (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table></td></tr>
<tr><td>Hooks and lines: No UK vessels have indicated that they use hooks and lines in the site (ISCZ, 2010). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a).
The estimated value of landings from the site is <£0.001m/yr (MCZ Fisheries Value Model).</td><td>The annual value of UK landings affected is estimated to fall within the following range:<table><tr><td>£m/yr</td><td>Scenario 1</td></tr><tr><td>Value of landings affected</td><td><0.001</td></tr></table></td></tr>
</table>

Table 2a. Commercial fisheries **rMCZ Reference Area Y, Barrow North**

Total direct impact on UK commercial fisheries

The annual value of UK landings and gross value added (GVA) affected is estimated to fall within the following range:

£m/yr	Scenario 1
Value of landings affected	<0.001
GVA affected	<0.001

NWIFCA and Whitehaven fishermen's association do not feel that fishers will be significantly impacted by rMCZ Reference Area Y. There is little evidence of fishing activity taking place within the site (NWIFCA & Cumbria Fisheries, 2011). Due to the size, location and intertidal nature of this site, it is highly unlikely that any commercial fishing takes place there. However, interviews with fishers have indicated that fewer than 5 UK vessels may be gill netting and bottom trawling in the site (ISCZ, 2010). However, this is likely to be incorrect and due to a mapping resolution error (Liaison officer, pers. comm., 2011). VMS data provides no evidence of fishing by over 15 metre UK vessels in the site (MMO, 2011a). Some vessels fishing in the site use more than one gear type. Where there is evidence of this (from Fishermap or MMO (2011b)), duplication has been removed so that the number below represents the minimum number of vessels fishing in the site impacted under each scenario:

Scenario 1: < 5

Baseline description of non-UK fisheries	**Costs of impact of rMCZ on non-UK commercial fisheries**
There is no evidence of non-UK vessels working in this site (Cowrie, 2010).	None.

Table 2b. Ports, harbours, shipping and disposal sites **rMCZ Reference Area Y, Barrow North**

Source of costs of the rMCZ

Management scenario 1: Not applicable to this site.

Management scenario 2: Increase in costs of assessing environmental impacts for future licence applications within 5km of an rMCZ. This applies to future navigational dredging, disposal of dredge material and port developments. Additional costs incurred in updating the existing Maintenance Dredging Protocol (MDP). It is not anticipated that any additional mitigation of impacts on features protected by the MCZ will be needed for port developments or port-related activities due to this rMCZ relative to the baseline.

Baseline description of activity	**Costs of impact of rMCZ on the sector**
Navigational dredge areas: The rMCZ is approximately 5km north of the main navigation channel into the port of Barrow. However, Walney Island and the adjoining spit lie between the rMCZ and the navigation channel.	*£m/yr* | Scenario 1 | Scenario 2

Maintenance dredging in the navigation channel takes place in order to maintain navigable depth, particularly to facilitate transit of nuclear submarines. As navigational dredging in this area is covered by an existing MDP, it is assumed that the assessment of environmental impact is not changed over the 20 year period of the IA. ***Port development:*** The rMCZ is approximately 5km to the north of the port of Barrow. However, Walney Island and the adjoining spit lie between the rMCZ and the navigation channel. No port developments are known to be planned within the 20-year period of the Impact Assessment (IA).	<table><tr><td>Cost to the operator</td><td>0.000</td><td>0.005*</td></tr></table> * This estimate for additional cost in future licence applications for port developments arising as a result of this rMCZ is not used to estimate the total costs for the IA. It is based on different assumptions to those used to estimate costs at a regional level and for the entire suite of sites. See Annex H12 for further information. This figure does not include the cost to include MCZ features in a MDP as it is not possible to break this down to each site. Instead it assumes that each dredge area's marine licence is renewed once every three years and that an assessment of environmental impact upon MCZ features is undertaken for each licence renewal. The Scenario 2 cost is likely to be smaller as navigational dredging in the area of this rMCZ is covered by a MDP. ***Scenario 1:*** Not applicable. ***Scenario 2:*** Future licence applications for navigational dredging and port or harbour development plans or proposals within 5km of the rMCZ will need to consider the potential effects of the activity on the features protected by the rMCZ. An additional cost will arise to update the existing MDP to consider the potential effects of activities on the features protected by the rMCZ. The anticipated additional cost in the MDPs is estimated to be a one-off cost of £8438. Sufficient information is not available to identify whether any additional mitigation of impacts on features protected by the MCZ will be needed for proposed future port and harbour developments relative to the mitigation provided in the baseline. Unknown potentially significant costs of mitigation could arise.

Table 2c. Recreation	**rMCZ Reference Area Y, Barrow North**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling in the entire site. Prohibition of wildfowling and kite surfing within the site.	
Baseline description of activity	**Costs of impact of rMCZ on this sector**
Angling: Shore and boat angling are known to take place in the area, targeting pollack, tope, codling, plaice, bass and mackerel. It is estimated that at least 40 anglers visit the site each year making repeat visits. This may not necessarily take place within the rMCZ though. (ISCZ, 2010). This is likely to be an overestimate as the numbers collected through interviews with recreational users were for areas larger than this site (ISCZ liaison officer, pers. comm., 2011). Bait (creeper rag) is reportedly collected from the gullies in the site (ISCZ liaison officer, pers. comm., 2011). ***Wildfowling:*** Walney Wildfowlers are known to be active in the site. The shoreline and land is reportedly owned by the Boughton Estate. The	***Angling:*** At least 40 anglers could be affected by the closure to angling, though this is likely to be an overestimate. It is anticipated that they will respond by fishing at alternative coastal locations in the north-west of England (Irish Sea Conservation Zones (ISCZ) liaison officer, pers. comm., 2011). This could impact on anglers' travel costs. However, no evidence of impact was identified through the ISCZ Project's consultation with anglers. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant. Though the impact on the UK economy is not likely to be significant, the impacts on individual anglers could be significant. ***Wildfowling:*** Wildfowling would not be allowed to continue in the site. This may have implications for wildfowling leases. It is not known how the wildfowlers may respond to the closure (Walney Wildfowlers who use the site declined to provide information). They may shoot

Table 2c. Recreation	**rMCZ Reference Area Y, Barrow North**
Source of costs of the rMCZ ***Management scenario 1:*** Closure of angling in the entire site. Prohibition of wildfowling and kite surfing within the site.	
Baseline description of activity	**Costs of impact of rMCZ on this sector**
association chose not to provide information for the IA. No further information is available (ISCZ, pers. comm., 2011). ***Kite surfing:*** Kite surfers have indicated that they use an area (which partially overlaps with the site) from March to December. They estimate that they use it for at least five days a month with up to 50 people in the group. They operate on the intertidal area (ISCZ, 2010). However, the actual level of activity in the site is likely to be smaller than this. This is likely to be an overestimate as the numbers collected through interviews with recreational users were for areas larger than this site (ISCZ liaison officer, pers. comm., 2011).	instead at alternative locations in the area or further afield. They may incur increased travel costs as a result. ***Kite surfing:*** No evidence of impact is available from stakeholders. Though the impact on the UK economy is not likely to be significant, the impacts on individual kite surfers could be significant.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	**rMCZ Reference Area Y, Barrow North**
Flood and coastal erosion risk management (coastal defence), water pollution from activities on land; and other recreation activities (including sailing, motor cruising, dinghy racing, collection of flotsam and jetsam). The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area Y, Barrow North**
Baseline	**Beneficial impact**	
Features to be protected by the rMCZ contribute to the delivery of fish and shellfish for human consumption (Fletcher and others (2012)). Due to the size, location and	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. The abundance,	Anticipated direction of

Table 4a. Fish and shellfish for human consumption		**rMCZ Reference Area Y, Barrow North**
intertidal nature of this site, it is highly unlikely that any commercial vessel fishing takes place (ISCZ liaison officer, pers. comm., 2011). There is likely to be some intertidal fishing activity in the site. Subtidal gravel and sand sediments are often important as nursery areas for fish such as plaice *Pleuronectes platessa* (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries (UK Biodiversity Partnership (2010) in Fletcher and others (2012)). Intertidal mud is an important area for juvenile fish such as plaice (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). It also supports sole, dab and flounder which feed on polychaetes, young bivalves and siphons (Jones, Hiscock & Connor (2000) in Fletcher and others (2012)). Intertidal mud provides habitat for fish of commercial importance (Humphreys and others (2007) in Fletcher and others (2012)). Saltmarshes provide nursery habitat for many species of juvenile fish, crustaceans and molluscs (Pennings & Bertness (2001) in Fletcher and others (2012)). The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when not in reference condition.	size/age, biomass and recruitment of fish in the site are also expected to benefit. These benefits are expected to accrue as a result of reduced fishing mortality and reduction of gear interaction with the sea bed (see Annex L). It is assumed that the site will be closed to all commercial fisheries. Therefore, there will be no benefits to fisheries. However, spill-over effects could generate benefits for vessels fishing just outside the rMCZ (Blythe and others, 2002; Reid, 2011; Bennett and Hough, 2007; Sweeting and Polunin, 2005; Partnership for Interdisciplinary Studies of Coastal Oceans (2011)). It is not possible to estimate the value to fishing vessels of this potential spill-over effect. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. As the rMCZ is small it is unclear whether it would have any impact on stocks of mobile commercial finfish species.	change: ⇧ Confidence: Low

Table 4b. Regulating services		**rMCZ Reference Area Y, Barrow North**
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon. Sedimentary fauna influence global carbon dioxide dynamics and hence global warming through their feeding and mixing activities (e.g. burrowing) which result in carbon metabolism and burial (Snelgrove (1999) in Fletcher and others (2012)). Through the processes that occur in their upper layers, marine sediments (including sand) have an important role in the global cycling of many elements, including carbon and nitrogen (Burdige (2006) in Fletcher and others (2012)). A considerable quantity of cadmium is stored in sediment by cord grass *Spartina anglica* growing in intertidal mud (Hubner and others (2010) in Fletcher and others (2012)). Intertidal mudflats store carbon at similar levels to freshwater wetlands/peatland areas (Andrews and others (2006); Chmura and others (2003) in Fletcher and others (2012)).	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Management of human activities in the site is expected to improve the condition and abundance of features in the site. Therefore, regulation of pollution services is anticipated to be of benefit. Designating the rMCZ is also likely to protect the MCZ features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities. This rMCZ, if designated, could help to safeguard cost savings of at least £28–52m of capital costs and £518,000 of annual maintenance costs that would otherwise be expended on coastal defence (see Annex L), based on the area of coastal saltmarsh	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4b. Regulating services		**rMCZ Reference Area Y, Barrow North**
As with other intertidal areas, areas dominated by aquatic angiosperms are significant carbon sinks, providing carbon storage at approximately ten times the rate observed in temperate forests and 50 times the rate observed in tropical forests per unit area (IUCN (2009) in Fletcher and others (2012)). These areas therefore contribute to the storage of carbon and thus have an important role within the carbon cycle (Ronnback and others (2007) in Fletcher and others (2012)). Wetlands (including saltmarshes) store a lot of carbon (Chmura and others (2003) in Fletcher and others (2012)). Saltmarshes are significant carbon sinks, providing carbon storage at approximately ten times the rate observed in temperate forests and 50 times the rate observed in tropical forests per unit area (IUCN (2009) in Fletcher and others (2012)). This has prompted the International Union for Conservation of Nature (IUCN) (2009; in Fletcher and others (2012)) to state that saltmarshes are 'critical components to include in future carbon management discussions and strategies'. Coastal saltmarsh vegetation is involved in the regulation of water purity through the take-up of excess inorganic nutrients such as nitrates and phosphates, thereby reducing the potential for eutrophication (Peterson and others (2008) in Fletcher and others (2012)). A study by Kay and others (2005; in Fletcher and others (2012)) in Clacton, Essex, showed a reduction of over 97% in the flux and concentrations of faecal organism indicators following the construction of a flood defence wall that created a marshland area. ***Environmental resilience:*** The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. ***Natural Hazard Protection:*** Intertidal mud areas and saltmarshes help to protect coastal margins from erosion by dissipating wave and current energy (Bale and others (2007a); Kirby & Kirby (2008); Pennings & Bertness (2001); all in Fletcher and others (2012)). Saltmarshes are known to accumulate sediment and organic matter at a rate that compensates for sea level rise (Morris (2007) in Fletcher and others (2012)). Saltmarsh environments in a variety of physical settings can significantly increase attenuation of incident waves compared with unvegetated sand/mudflats. This is especially relevant with the increased risk of sea level rise and an increase in storm frequency (Moller (2006) in Fletcher and others (2012)). The baseline quantity and	and saline reedbeds in the site. This will help to protect infrastructure (including an airport privately owned by BAE Systems) adjacent to this site.	

Table 4b. Regulating services	**rMCZ Reference Area Y, Barrow North**	
quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.		

Table 4c. Recreation	**rMCZ Reference Area Y, Barrow North**	
Baseline	**Beneficial impact**	
Shore and boat angling are known to take place in the site, targeting pollack, tope, codling, plaice, bass and mackerel. It is estimated that at least 40 anglers visit the site each year (ISCZ, 2010). Bait is reportedly collected (creeper rag) from the gullies in the site (ISCZ liaison officer, pers. comm., 2011). Walney Wildfowlers are known to be active in the site. Kite surfers have indicated that they use the site from March to December. They estimate that they use the site at least five days a month with up to 50 people in the group. They operate on the intertidal area. Fletcher and others (2011) state that the features to be protected by the rMCZ can contribute to the delivery of recreation and tourism services. In particular, intertidal mud is an important feeding ground for wading birds all year round (Bale and others (2007) in Fletcher and others (2012)) and migrating birds such as Brent geese, shelducks, pintails, oystercatchers, ringed plovers, grey plovers, bar-tailed and black-tailed godwits, curlews, redshanks, knots, dunlins and sanderlings (Jones, Hiscock. & Connor, 2000). Many birds use marshes as nurseries (Pennings & Bertness (2001) in Fletcher and others (2012)). For example, in the North Kent Marshes Environmentally Sensitive Area, coastal marshes support large breeding populations of lapwing *Vanellus vanellus* and redshank *Tringa tetanus* (Milsom and others (2002) in Fletcher and others (2012)). The MCZ features will also provide biological processes that support various fish species which, in turn, will benefit anglers. The baseline quantity and quality of the ecosystem service provided is assumed to be commensurate with that provided by the features of the site when in an unfavourable condition.	If the conservation objectives of the features are achieved, the features will be recovered to reference condition. Due to the ecological services of features to be recovered in the site, MCZ designation may lead to an increase, in time, of anglers and bird watchers to the site, which may benefit the local economy. Various studies demonstrate the local economic value of sea angling (Scottish Government, 2009; Invest in Fish South West, 2005); however, it has not been possible to quantify the potential impact for this rMCZ. Sea birds are known to attract visitors, which in turn generates local economic value. A study of four Royal Society for the Preservation of Birds (RSPB) marine reserves has highlighted the fact that, on average, an estimated additional income of £300,000 a year can be generated and directly attributed to sea bird watching within a designated nature reserve (RSPB, 2010). On average, this has supported up to the equivalent of an additional nine full-time jobs at each reserve. While this is the estimated local economic value generated in the absence of MCZs, it emphasises that MCZs could provide ecological benefits for sea birds which in turn could generate local economic value if sea bird numbers increase or are given more protection. However, it is not clear from the research if economic value is likely to increase with sea bird numbers or additional protection. It is, however, likely that a better quality of experience (i.e. more sea birds) would attract more visitors. Regardless, such impacts are likely to be local and represent a redistribution of sea bird watching rather than an overall increase in bird watchers nationally.	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4c. Research and education	**rMCZ Reference Area Y, Barrow North**	
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4d. Non-use and option values	**rMCZ Reference Area Y, Barrow North**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger and others, 2011), two 'nominated sites' fall within the boundary of rMCZ Reference Area Y. The sites were nominated for the range of marine diversity found in the site. The views presented here cannot be assumed to be representative of the UK's population and are subject to bias and gaps (for further details see Annex H). Management of sheep grazing in the intertidal areas of this site could help compliance with bathing water standards (Environment Agency, pers. comm. 2011).	Anticipated direction of change: ⇧ Confidence: Moderate

Recommended Marine Conservation Zone (rMCZ) Reference Area Z, Sefton Coast — Site area (km^2): 0.007

Table 1. Site-specific benefits arising from the MCZ (over 2013 to 2032)

Table 1. Conservation impacts — **rMCZ Reference Area Z, Sefton Coast**

1a. Ecological description

This site falls partly within rMCZ 13 and is situated adjacent to the settlement of Hightown on the Sefton coast. It is situated in the intertidal zone, extending from the mean high water mark to the mean low water mark, and overlaps with the Sefton Coast Special Area of Conservation (SAC). The site was proposed for protection of peat and clay exposures. This habitat feature is of archaeological interest, as the exposures are composed of former lake-bed sediments and ancient forested peatland (Roberts and others (1996) in ISCZ, 2011).

Benthic habitats formed from exposed peat or clay, or in some cases both, are uncommon and provide important habitats for a variety of species such as: burrowing bivalves, including piddocks *Pholas dactylus*, *Barnea candida* and *Barnea parva*, seaweeds and crabs (NBN Gateway (2011) in ISCZ, 2011). Depending on the level of sand scour present, the surface of peat exposures can be covered with algal mats made of red and green seaweeds *Ceramium* sp. and *Ulva lactuca* and *Ulva intestinalis*. Hydroids can be present within small pools of water and crabs shelter within crevices, e.g. *Carcinus maenas* and *Cancer pagurus* (Maddock (2010) in ISCZ, 2011). On the surface of clay exposures there tends to be less seaweed coverage; instead, small clumps of blue mussels *Mytilus edulis* can be present, alongside barnacles and periwinkles *Littorina littorea*, while polychaete worms live within the clay, e.g. *Polydora* sp. and *Hediste diversicolor* (Maddock (2010) in ISCZ, 2011). Both peat and clay exposures are soft enough to be burrowed into by piddocks *Pholas dactylus*, and the holes created by these burrowing bivalves provide an important microhabitat for species such as crabs and anemones, e.g. the daisy anemone *Cereus pedunculatus* and the gem anemone *Aulactinia verrucosa* (Maddock (2010) in ISCZ, 2011). In clay-rich areas common mussels, periwinkles and polychaete worms have also been noted. Source: ISCZ (2011).Source: ISCZ (2011)

1b. MCZ Feature Baseline and Impact of MCZ

Feature	Area of feature (km^2)	No. of point records	Baseline	Impact of MCZ
Habitats of Conservation Importance				
Peat and Clay Exposures	-	1	Unfavourable condition	Recover to reference condition

1c. Contribution to an ecologically coherent network

To be completed. Awaiting NE/JNCC.

Table 2. Site-specific costs arising from the effect of the rMCZ on human activities (over 2013 to 2032 inclusive)

Table 2a. Archaeological heritage — **rMCZ Reference Area Z, Sefton Coast**

Source of costs of the rMCZ

Increase in costs of assessing environmental impacts for future licence applications. Archaeological excavations, surface recovery and intrusive surveys will be prohibited from the entire site. Diver trails, visitors and non-intrusive surveys will be allowed.

Baseline description of activity	Costs of impact of rMCZ on the sector
The site covers part of the Hightown peat and forest beds. These are important for the rare preservation of organic remains (plants and animal fossils) of mid-Holocene growth, and for their underlying clay deposits (English Heritage, pers. comm., 2012). English Heritage has indicated that this site is likely to be of interest for archaeological excavation in the future as it is relevant to its National Heritage Protection Plan (theme 3A1.2)	An extra cost would be incurred in the assessment of environmental impacts made in support of any future licence applications for archaeological activities in the site. The likelihood of a future licence application being submitted is not known so no overall cost to the sector of this rMCZ has been estimated. However, the additional cost of one licence application could be in the region of £500 to £10,000 depending on the size of the MCZ (English Heritage, pers. comm., 2012). The impact on the UK economy is not likely to be significant. If archaeologists respond to the prohibition of excavation by undertaking an alternative archaeological excavation in another locality, this could result in additional costs to the archaeologists. As it is not possible to predict when or how often this could occur, this is not costed in the Impact Assessment (IA). The prohibition of excavation and therefore interpretation of archaeological evidence from the site will decrease acquisition of historical knowledge of past human communities from the site, resulting in a cost to society.

Table 3. Human activities in the site that are not negatively affected by the rMCZ (over 2013 to 2032 inclusive)

Table 3. Human activities in the site that are not negatively affected by the rMCZ (existing activities at their current levels and future proposals known to the regional MCZ projects)	rMCZ Reference Area Z, Sefton Coast
There is no evidence of other activities in the site. The IA assumes that no additional mitigation of impacts of water abstraction, discharge or diffuse pollution will be required over and above that which will be provided to achieve the objectives of the Water Framework Directive through the River Basin Management Plan process (based on advice provided by Natural England, pers. comm., 2010).	

Table 4. Anticipated benefits to ecosystem services

The habitats, species and other ecological features of the rMCZ contribute to the delivery of a range of ecosystem services. Designation of the rMCZ and its subsequent management may improve the quantity and quality of the beneficial services provided, which may increase the value (welfare) derived from them. Impacts on the value derived from ecosystem services may occur as a result of the designation, management and/or achievement of the conservation objectives of the rMCZ. Further discussion on the potential benefits to ecosystem services can be found in Annex L and definitions in Annex H5.

Table 4a. Regulating services	rMCZ Reference Area Z, Sefton Coast	
Baseline	**Beneficial impact**	
Regulation of pollution: The features of the site contribute to the recycling of waste and capture of carbon.	If the conservation objectives of the features are achieved, the features will be maintained in reference condition. No change in feature condition and management of human activities is expected and therefore no benefit to the	Anticipated direction of change:

Table 4a. Regulating services	**rMCZ Reference Area Z, Sefton Coast**	
Environmental resilience: The features of the site contribute to the resilience and continued regeneration of marine ecosystems. The level of the service that is provided is related to the diversity and condition of species and habitats in the rMCZ, and the range of their sensitivity to different impacts. The baseline quantity and quality of the ecosystem service provided is assumed to be the same as that provided by the features of the site when in an unfavourable condition.	regulation of pollution is expected. Designating the rMCZ will protect its features and the ecosystem services that they provide against the risk of future degradation from pressures caused by human activities (as, if necessary, mitigation would be introduced, with the associated costs and benefits).	⟺ Confidence: Moderate

Table 4b. Research and education	**rMCZ Reference Area Z, Sefton Coast**	
Baseline	**Beneficial impact**	
The extent of research undertaken in the site is not known. Peat and clay exposures are an important archaeological resource which may potentially provide historical and environmental data about human activity.	Designation as an rMCZ Reference Area will provide an opportunity to demonstrate the state of the site's designated marine features, in the context of prevailing environmental conditions and in the absence of many anthropogenic pressures (Natural England & JNCC, 2010). It will provide a control area against which the impacts of pressures caused by human activities can be compared as part of long-term monitoring and assessment. Other research benefits are unknown. It has not been possible to estimate the value derived from research activities associated with the rMCZ.	Anticipated direction of change: ⇧ Confidence: High

Table 4c. Non-use and option values	**rMCZ Reference Area Z, Sefton Coast**	
Baseline	**Beneficial impact**	
Some people gain satisfaction from the existence of marine habitats, species and other features. They also gain from having the option to benefit in the future from the habitats and species in the rMCZ and the ecosystem services provided, even if they do not currently benefit from them.	The rMCZ will benefit the proportion of the UK population that values conservation of the rMCZ features and its contribution to an ecologically coherent network of Marine Protected Areas (MPAs). Some people will gain satisfaction from knowing that the habitats and species are being conserved (existence value) and/or that they are being conserved for use by others in the current generation (altruistic value) or future generations (bequest value). The rMCZ will protect the features and the ecosystem services provided, and thereby the option to benefit from these services in the future, from the risk of future degradation. In the Marine Conservation Society's 'Your Seas Your Voice' campaign (Ranger	Anticipated direction of change: ⇧ Confidence: Moderate

Table 4c. Non-use and option values		**rMCZ Reference Area Z, Sefton Coast**
	and others, 2011), two 'nominated sites' fall within the boundary of rMCZ Reference Area Y. The two recreational users that nominated these sites cited 'the spectacular undersea plants and animals', and the '[presence of] whales, dolphins, seals and sharks' as reasons for protection. These are examples of the reasons why some people would like areas within this MCZ to be protected. The views presented here cannot be assumed to be neither accurate, representative of the UK's population and may be subject to bias and gaps (for further details see Annex H).	

References

Adey, J.M. Atkinson, R.J.A. Smith, I.P. Tuck, I.D. Taylor A.C. (2006). 'The environmental impact of the N*ephrops* creel fishery'. Scottish Natural Heritage.

Adey, J. A. (2007). 'Aspects of the sustainability of creel fishing for Norway lobster, *Nephrops norvegicus* (L.), on the west coast of Scotland'. PhD D thesis, University of Glasgow.

Al-Raei, A.B. 2009. Seasonal dynamics of microbial sulfate reduction in temperate intertidal surface sediments: controls by temperature and organic matter, *Ocean Dynamics*, 59, 351–370.

ANIFPO. 2011. *Qualitative assessment of the impact of MCZs upon the ANIFPO fleet meeting,* 3 August 2011

Anthony, E. 2008. Gravel Beaches and Barriers. *In: Developments in Marine Geology*, 4. London: Elsevier.

Baker, J.M. 1987. Intertidal Rock. *In:* Baker, J.M., *Biological Surveys of Estuaries and Coasts*. 157–196. Cambridge: Cambridge University Press.

Belgian Fisheries Representative (2011) *MCZ Impact Assessment Questionnaire 2011*

Bennett, D. and Hough, A. 2007. *Loch Torridon Nephrops Creel Fishery: Certification Report*. Moody Marine Ltd.

Blythe, R., Kaiser, M., Hart, P. & Edwards-Jones, G. 2002. Voluntary mangement in an inshore fishery has conservation benefits, *Environmental Conservation*, 29, 493–508.

Bolam, S. & Fernandes, T. 2003. Dense aggregations of Pygospio elegans (Claparède): effect on macrofaunal community structure and sediments, *Journal of Sea Research*, 49, 171–185.

Burdige, D.J. 2006. *Geochemistry of Marine Sediments.* Princeton, NJ: Princeton University Press.

Cayocca, F.B. 2008. Sedimentary processes in a shellfish farming environment, Mont Saint Michel Bay, France. *Proceedings in Marine Science*, 9, 431–446.

Cebrian, E.B. 2000. Shallow rocky bottom benthic assemblages as Calcium Carbonate produces in the Alboran Sea, *Oceanol. Acta.*, 23(3), 311–322.

Connell, J. 1961. Influence of interspecific competition and other actors on distribution of barnacle Chthamalus stellatus, *Ecology*, 42, 710–723.

De Beer, D.W. 2005. Transport and mineralization rates in North Sea sandy intertidal sediments, Sylt-Romo Basin, Wadden Sea, *Limnology and Oceanography*, 50, 113–127.

Direction des Pêches Maritimes et de l' Aquaculture . 2011. *dpma-11-0339-mcz-zonesbritanniques:* URL: password protected.

Dubois, S.C. 2006. Effects of epibionts on Sabellaria alveolata (L.) biogenic reefs and their associated fauna in the Bay of Mont Saint-Michel, *Estuarine and Coastal Shelf Science*, 68, 635–646.

Ellis, J. and others. 2012. *Spawning and Nursery Grounds of Selected Fish Species in UK Waters.* Science Series Technical Report, 147. Lowestoft: Cefas.

Evans, P.W. 1998. Creation of temperate-climate intertidal mudflats: Factors affecting colonization and use by benthic animals and their bird predators, *Marine Pollution Bulletin*, 37, 535–545.

Finnegan, P., Vintro, L., Mitchell, P., Boust, D., Gouzy, A., Kershaw, P.J. & Lucey, J. 2009. Accumulation, solid partitioning and remobilisation of 99Tc in subtidal and intertidal sediments in the Irish Sea, *Continental Shelf Research*, 29, 1995–2010.

Fletcher, S., Saunders, J., Herbert, R., Roberts, C. & Dawson, K. 2012. *Marine Ecosystem Services: Description of the Ecosystem Services Provided by Broadscale Habitats and Features of Conservation Importance That are Likely to be Protected by Marine Protected Areas in the Marine Conservation Zone Project Area.* Natural England Commissioned Reports, 88.

Forster, S. & Graf, G. 1995. Impact of irrigation on oxygen flux into the sediment: intermittent pumping by Callianassa subterranea and 'piston-pumping' by Lanice conchilega, *Marine Biology*, 335–346.

Fortes, M. 2002. Natural biological processes and controls, *Proceedings in Marine Science*, 4, 229–244.

Greathead, C.F., Donnan, D.W., Mair, D.M. (2005) 'Impact of Nephrops trawling on the distribution of the sea pens Virgularia Mirabilis, Pennatula phosphorea and Funiculina quadrangularis in Scottish waters'. Scottish Natural Heritage. Fisheries Research Services Internal Report No 02/05.

Gunderson, D.R. & Vetter, R.D. 2006. Temperate rocky reef fish, *Marine Metapopulations*, 69–117. London: Elsevier.

Hawkins, S.S. 2009. Consequences of climate-driven biodiversity changes for ecosystem functioning of North European rocky shores, *Marine Ecology Progress Series*, 396, 245–259.

Hill, J.P. 2010. *Meeting the MPA Network Principle of Viability: Feature Specific Recommendations for Species and Habitats of Conservation Importance.* Marine Ecological Surveys Limited.

Hill, J.M. 2008. *Sea pens and burrowing animals in circalittoral soft mud. Marine Life Information.* Plymouth: Marine Biological Association.

Hill, S.B. 1998. *Intertidal Reef Biotopes: an Overview of Dynamic and Sensitivity Characteristics for Conservation Management of Marine SACs.* Oban: Scottish Association for Marine Science (UK Marine SACs Project).

Hinz, H., Prieto, V. & Kaiser, M.J. 2009. Trawl disturbance on benthic communities and chronic effects and experimental predictions, *Ecological Applications,* 19(3), 761–773.

Hiscock, K. & Marshall, C. 2006. *The Structure and Functioning of Marine Ecosystems: an Environmental Protection and Management Perspective.* English Nature Research Reports, 699: Report to English Nature from the Marine Life Information Network (MarLIN). Plymouth: Marine Biological Association.

Holt, T.J., Rees, E.I., Hawkins, S.J. & Seed, R. 1998. *Biogenic Reefs (Volume IX). An Overview of Dynamic and Sensitivity Characteristics for Conservation Management of Marine SACs.* Scottish Association for Marine Science (UK Marine SACs Project).

Invest in Fish South West. 2005. *The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region.* Report.

ISCZ. 2010. *FisherMap project.*

Jones, L.A., Hiscock, K. & Connor, D.W. 2000. *Marine Habitat Reviews. a Summary of Ecological Requirements and Sensitivity Characteristics for the Conservation and Management of Marine SACs.* Peterborough: JNCC.

Kaiser, M.J., Spence, F.E. & Hart, P.J.B. (2000) 'Fishing-gear restrictions and conservation of benthic habitat complexity.' *Conservation Biology* 14 (5): 1515–1525.

Kogure, K. & Wada, M. 2005. Impacts of macrobenthic The burrowing activity in marine sediment on bacterial metabolic activity, *Microbes and Environments*, 20(4), 191–199.

Lancaster, J. and Savage, A. 2008. How do you solve a problem like *Sabellaria*? *In Practice.*

Liehr, G.Z. 2005. The ocean quahog Arctica islandica L.: a bioindicator for contaminated sediments, *Marine Biology*, 147, 671–679.

Magalhaes, C.B. 2003. Intertidal biofilms on rocky substratum caplay a major role in estuarine carbon and nutrient dynamics, *Marine Ecology Progress Series*, 258, 275–281.

Maitland, P. 2003. *The Status of Smelt* Osmerus eperlanus *in England.* English Nature Research Report 516.

McManus, J. 2001. Coral Reefs. *In: Encyclopedia of Ocean Sciences*, 524–534.

Mermillod-Blondin, F.M. 2003. Assessment of the spatial variability of intertidal benthic communities by axial tomodensitometry: importance of fine-scale heterogeneity, *Journal of Experimental Marine Biology and Ecology*, 287, 193–208.

MMO. 2011a. *Vessel monitoring system spatial attribute data 2006–2010.* Newcastle upon tyne: Marine Management Organisation.

MMO. 2011b. *IFISH Database 2007 to 2010.* Newcastle upon tyne: Marine Management Organisation.

NIFPO. 2011. *Qualitative assessment of the impact of MCZs upon the NIFPO fleet meeting,* 2 August 2011.

OSPAR. 2008. *Case Reports for the OSPAR List of Threatened and/or Declining Species and Habitats.* London: OSPAR Commission.

Paramour, O. & Frid, C. 2006. *Marine Ecosystem Objectives: Further Development of Objectives for Defra.* London: Defra.

Partnership for Interdisciplinary Studies of Coastal Oceans 2011. *The Science of Marine Reserves*. 2nd edn, Europe. URL: www.piscoweb.org

Rabaut, M.V. 2010. Biogenic reefs as structuring factor in Pleuronectes platessa (plaice) nursery, *Journal of Sea Research*, 64, 102–106.

Ranger, S., Lowe, R., Sanghera, A. & Solandt, J. 2011. *An Assessment of Non-use Value and Other Benefits of rMCZs in England.* Ross-on-Wye: Marine Conservation Society.

Rees, H. & Dare, J. 1993. *Sources of Mortality and Associated Life-cycle Traits of Selected Benthic Species: a Review.* Lowestoft: MAFF Fisheries Research Data Report, 33.

Reid, A. 2011. *The Isle of Man Queen Scallop Fishery – Partnership and Success.* Shellfish Association of Great Britain Conference, www.slideshare.net/SAGB_Conference/andy-reid-2011 (accessed 28 May 2012).

Riding, R. 2002. Structure and composition of organic reefs and carbonate mud mounds: concepts and categories, *Earth-Science Reviews*, 58, 163–231.

RSPB. 2010. *The Local Value of Seabirds: Estimating Spending by Visitors to RSPB Coastal Reserves and Associated Local Economic Impact Attributable to Seabirds.*

Sabatini, M.P. 2008. *Arctica islandica. Icelandic cyprine.* Marine Life Information Network Biology and Sensitivity Key Information Sub-programme. Plymouth: Marine Biological Association.

Scottish Government. 2009. *Economic Impact of Recreational Sea Angling in Scotland.*

Seaton Bay. 2012. *Seaton Marshes Local Nature Reserves* www.seatonbay.com/adventure/marshes.html (accessed 21 April 2012).

Sewell, J.A. 2005. *Effects of Fishing within UK European Marine Sites: Guidance for Nature Conservation Agencies.* Plymouth: Marine Biological Association.

Snelgrove, P. 1999. Getting to the bottom of marine biodiversity: sedimentary habitats. Ocean bottoms are the most widespread habitat on Earth and support high biodiversity and key ecosystem services, *Bioscience*, 49(2), 129–138.

Stakeholder Focus Meeting. 2011:

- rMCZs 4 and 5, covering reference area C, 24 March 2011, Liverpool
- rMCZs 6 and 7, covering reference areas F and G, 29 March 2011, Belfast

- rMCZs 2 and 3, covering reference areas B and S, 31 March 2011
- rMCZs 1 and 10, covering reference areas A and H, 5 April 2011
- rMCZs 13 and 14, covering reference area Z, 12 April 2011

Sweeting, C. and Polunin, N. 2005. *Marine Protected Areas for Management of Temperate North Atlantic Fisheries.* London: Defra.

UK Biodiversity Partnership. 2010. *UK BAP Priority Species and Habitats*. Peterborough: JNCC.

Underwood, G.A. 2003. *The importance of extracellular carbohydrate production by marine epipelic diatoms.* Swindon: Natural Environment Research Council.

Whitehaven Fishermen's Association & NWIFCA. 2011. *Qualitative assessment of the impact of MCZs upon the Cumbrian fleet meeting,* 3 August 2011.