

# DATA CONFIDENCE ASSESSMENT

## Outer Belfast Lough Proposed Marine Conservation Zone (pMCZ)

Ocean quahog (*Arctica islandica*)



<b>Document version control</b>			
<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Comments</b>
Version 0.1	01/06/2015	Clara Alvarez Alonso	Template – Belfast Lough Initial draft
Version 0.2	10/08/2015	Liz Pothanikat	Amendments
Version 0.3	19/10/2015	Liz Pothanikat, Clara Alvarez Alonso, Stephanie Bennett, Joe Breen, Nuala McQuaid	Amendments
Version 1.1	16/11/2015	Stephanie Bennett	Amendments

<b>Distribution List</b>		
<b>Version</b>	<b>Issue date</b>	<b>Issued to</b>
Version 1.0	28/10/2015	Internal Consultation
Version 2.0	14/12/2015	Public Consultation

## **Contents**

<b>Executive Summary</b> .....	<b>3</b>
<b>Glossary of Terms and Acronyms</b> .....	<b>4</b>
<b>Data Confidence assessment</b> .....	<b>10</b>
Age of data (Figure 3).....	10
Source of data (Figure 4) .....	10
Sampling methods / resolution.....	11
Data coverage (Figures 3 to 6) .....	11
<b>The Evidence Base (Figures)</b> .....	<b>14</b>
<b>Data sources and Bibliography</b> .....	<b>16</b>

## **Executive Summary**

The data confidence assessment is a document produced as part of the consultation evidence base and, similar to other documents, follows the OSPAR design principles. The assessment details our confidence in the data used to identify Areas of Search (AoS) and determine features proposed for protection within proposed Marine Conservation Zones (pMCZ). This includes data type, age, source and coverage.

This document provides details of the data confidence assessment for Outer Belfast Lough pMCZ.

Additional information on Outer Belfast Lough pMCZ and proposed features includes:

- Guidance on selection and designation of Marine Conservation Zones (MCZs) in the Northern Ireland Inshore Region
- Justification report for selection of proposed Marine Conservation Zone (pMCZ) features
- Guidance on the development of Conservation Objectives and Potential Management Options
- Site Summary Document for Outer Belfast Lough proposed Marine Conservation Zone (pMCZ)
- Conservation Objectives and potential Management Options for Outer Belfast proposed Marine Conservation Zone (pMCZ)
- Assessment against Selection Guidelines for Outer Belfast Lough proposed Marine Conservation Zone (pMCZ)
- Data Confidence Assessment for Outer Belfast Lough proposed Marine Conservation Zone (pMCZ)

## Glossary of Terms and Acronyms

**AoS** –Area of Search used to underpin the proposed Marine Conservation Zone

**AFBI** - Agri-food and Biosciences Institute

**EUNIS** –The European nature information system, is a habitat classification system used throughout Europe and covers all types of natural and artificial habitats, both aquatic and terrestrial

**MCZ** - Marine Conservation Zone used to refer to MCZs designated under section 13 of the Marine Act (Northern Ireland) 2013 in the Northern Ireland inshore region and in section 116 of the Marine and Coastal Access Act 2009 in the Northern Ireland offshore region adjacent to Northern Ireland

**OQ** – Ocean quahog

**OSPAR** - OSPAR is the mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Union, cooperate to protect the marine environment of the North-East Atlantic

**OSPAR T&D** - OSPAR List of Threatened and/or Declining Species and Habitats

**pMCZ** - Proposed Marine Conservation Zone

**pMCZ Feature** - proposed Marine Conservation Zone features that will underpin the MCZ designation

**PSA** - Particle Size Analysis

**SPBM** - Sea-pen (*Virgularia mirabilis*) and burrowing megafauna communities

**SS** - Subtidal (sublittoral) sand

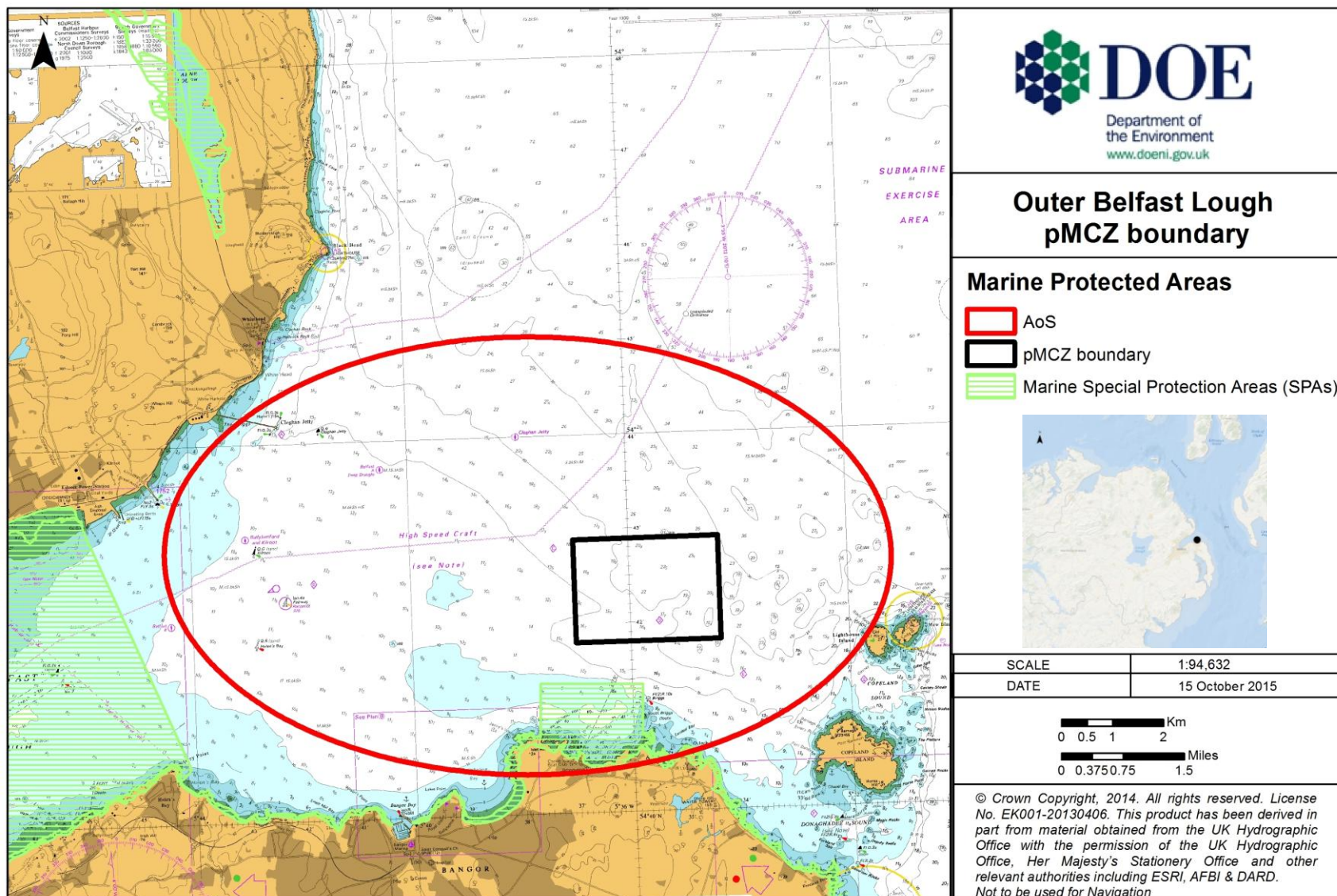
<b>Proposed MCZ name</b>	Outer Belfast Lough	<b>Assessors</b>	CA; CAA; JB; LP; NMcQ; SB
<p>The Outer Belfast Lough pMCZ (see Figure 1) is located at the entrance of the sea inlet, close to the southern shore of the Lough (North of Groomsport).</p> <p>The pMCZ contains dense populations of the long-lived Ocean quahog (<i>Arctica islandica</i>) (OQ) which is an OSPAR Threatened and/or Declining species (OSPAR, 2009). This low mobility species appears to be restricted to a small area that is defined by the proposed boundary. The density in the pMCZ is high (4.5 individuals per m<sup>2</sup>) with particular abundance in the northern section of the pMCZ at around 22m depth (Ridgway <i>et al.</i>, 2012). This is a relatively dense population for UK waters, and only in the northern North Sea have higher densities been reported (De Wilde <i>et al.</i>, 1986). High densities of OQ have been positively correlated with the presence of subtidal fine sands/muddy sands. Although it is unclear why areas with fine sediments favour high densities of OQ, it is suggested that the recruitment success might be related to larval dispersion and settlement in this sediment type (Witbaard and Bergman, 2003).</p> <p>The habitat Subtidal (sublittoral) sand (SS) (<a href="#">EUNIS Habitat type A5.2</a>) (JNCC, 2008) is included for its importance in supporting the ecosystem related to the OQ presence. The SS habitat is broadly distributed through the pMCZ with sediments from coarse gravelly sand to stable infralittoral and circalittoral finer sands and muddy sands. Finer components of the muddy sand/fine sand sediment habitat also support the Sea-pen (<i>Virgularia mirabilis</i>) and burrowing megafauna communities (SPBM) in a variation of the circalittoral mud biotope described by OSPAR (JNCC, 2014 &amp; Hughes, 1998).</p> <p>The boundary of the pMCZ was drawn to encompass the extent of the OQ and to represent the range in diversity of SS habitat within the area. A buffer zone of 500m was incorporated into the boundary; this was based on the suggested minimum distance for larval dispersal of 0.5 km<sup>2</sup>. An area of 5.75 km<sup>2</sup> is sufficient to be self-sustaining for SS and the majority of its diversity (Natural England &amp; JNCC, 2010 &amp; Hill <i>et al.</i>, 2010).</p>			

<b>Protected features (see figure 2)</b>			
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>• Ocean quahog (<i>Arctica islandica</i>) (OQ)</li> <li>• Subtidal (sublittoral) sand (SS)               <ul style="list-style-type: none"> <li>- SS: Sea-pen and burrowing megafauna communities (SPBM) (component habitat)</li> </ul> </li> </ul>	<b>Geodiversity</b>	n/a

Data used in assessment			
<b>Version of Marine recorder database</b>	<i>Update Nov2014</i>	<b>Other datasets used (specify)</b>	<ul style="list-style-type: none"> <li>- <sup>1</sup>Bangor University Ocean quahog in Belfast Lough -grab and dredge surveys June 2005, July 2008, September 2008 and April 2010.</li> <li>- <sup>2</sup>DOE North Channel disposal grounds monitoring programme 1990-2014 (DOE-Marine recorder database).</li> <li>- <sup>3</sup>DOE Belfast grab survey (Marine Coastal Access Act) 2012</li> <li>- <sup>4</sup>JNCC EU SeaMap predicted habitat maps 2014 v8.3 and UK SeaMap 2010.</li> <li>- <sup>5</sup>AFBI cruise CO0715 - video tows and grab survey 2015.</li> <li>- <sup>6</sup>DOE Outer Belfast Lough pMCZ spyball surveys 2015 – drop-camera underwater video/still images, infaunal grab samples and Particle Size Analysis (PSA).</li> <li>- <sup>7</sup>DOE Outer Belfast Lough pMCZ diving survey 2015 – ground truthing.</li> <li>- <sup>8</sup>DOE Outer Belfast Lough Side-scan sonar survey 2015</li> </ul>

Summary of data confidence assessment						
Confident in underpinning data		Yes	✓	Partial		No
Confident in presence of identified features?	✓	Data suitable to define extent of individual protected features		✓	Partial	*
				OQ	SS; SS:SPBM	
<b>Summary</b>	<p>The Department has high confidence in the presence of the proposed features and the supporting evidence in the pMCZ.</p> <p>Most of the records for OQ were collected during dedicated surveys, delivered by Bangor University, which took place in June 2005, July 2008, September 2008 and April 2010 using beam trawl, grabs and tows as sampling methods<sup>1</sup>. Additionally, AFBI cruise CO0715<sup>5</sup> reported more evidence of OQ in the central area with one out of three total grab samples. DOE North channel monitoring surveys<sup>2</sup> and DOE pMCZ support survey<sup>6</sup> also recorded multiple OQ records collected from several grabs during annual surveys. These datasets support high confidence in defining the extent of the pMCZ boundary around the low mobility species records.</p> <p>The evidence for the presence of SS in the AoS is supported by the broad coverage of grab samples and PSA analysis carried out in different DOE monitoring programmes (DOE North Channel disposal grounds monitoring programme 1990-2014<sup>2</sup>; DOE Belfast grab survey (Marine Coastal Access Act) 2012<sup>3</sup>; DOE Outer Belfast Lough pMCZ survey 2015<sup>6</sup>) confirming the sediment types which underpin the predictive habitat mapping projects used in the assessment (UK and EU SeaMap habitat maps<sup>4</sup> and AFBI acoustic facies<sup>5</sup>).</p> <p>The survey work undertaken in 2015 by DOE<sup>6</sup> using an underwater camera confirmed the presence of SPBM (biotope <a href="#">SS.SMu.CFiMu.SpMg</a>) with high densities of burrows and mounds (frequent on the <a href="#">SACFOR scale</a>) (JNCC, 2014) and occasional sea-pens. This biotope had been previously identified by AFBI cruise CO0715<sup>5</sup> earlier in 2015 using both grabs and video tows. Both surveys also support the extent of the boundary with the verification of suitable habitat (SS) for Ocean quahog</p> <p>Side-scan images<sup>8</sup> clearly identified two distinct acoustic facies comprising smoother sediments to the north and rougher sediments to the south. This was verified during the dive survey<sup>7</sup> and corroborated by the grab samples, spyball<sup>6</sup> and towed camera surveys<sup>5</sup>.</p>					





**Figure 1** Location of Area of Search and the proposed boundary of Outer Belfast Lough pMCZ

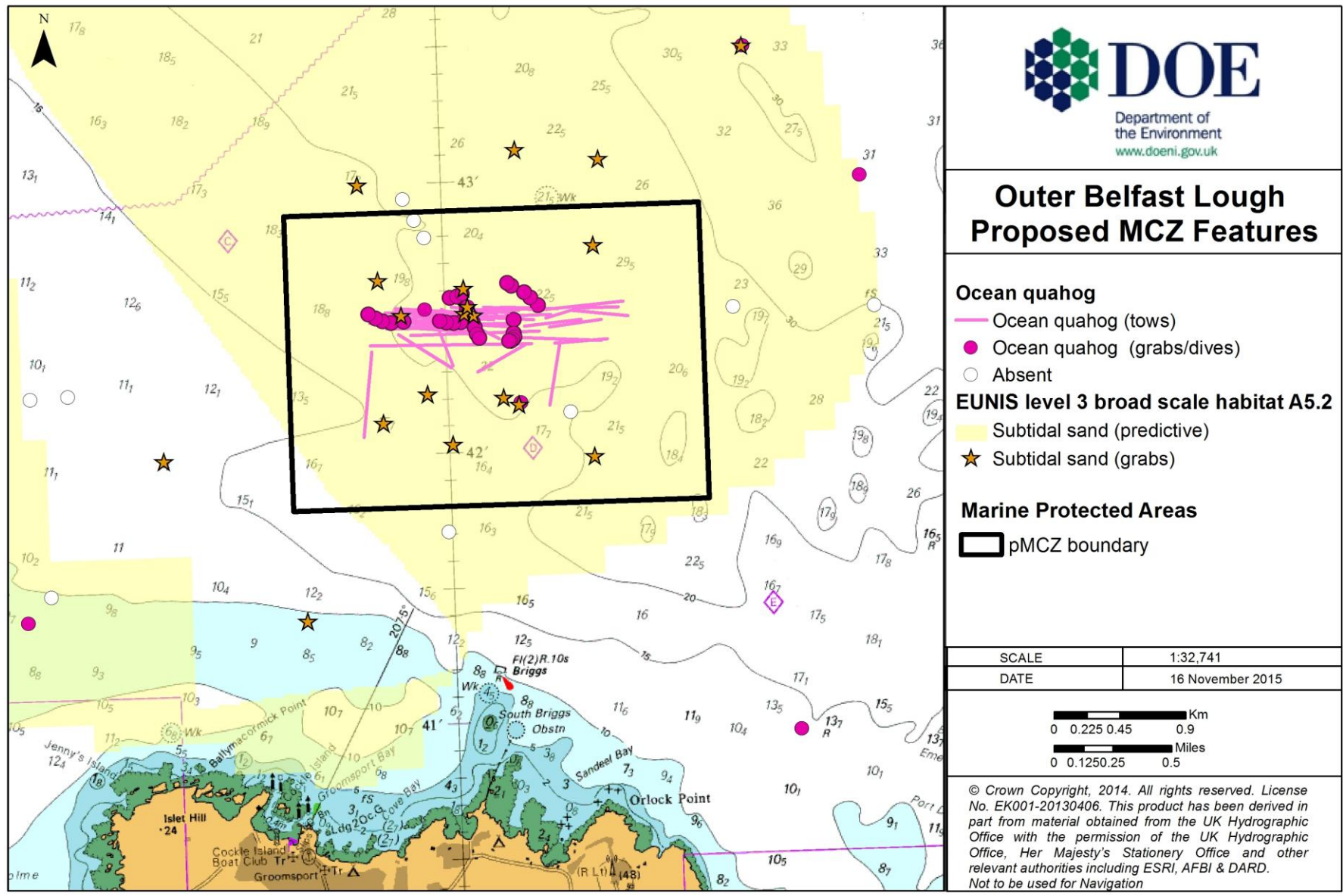


Figure 2 Distribution of the pMCZ features in Outer Belfast Lough

## Data Confidence assessment

The Assessment of Data Confidence is based on a consideration of the age and source of the data, the type of sampling methodologies used and the coverage across the overall pMCZ.

### Age of data (Figure 3)

<b>Multiple records collected within last 10 years</b>	OQ SS SS:SPBM	<b>Multiple records collected 10-25 years ago</b>	OQ	<b>Multiple records &gt;25 years old</b>	X
<b>Comments</b>	<p>Within the pMCZ, the majority of data for Ocean quahog was collected during dedicated grab surveys in (2005, 2008 and 2010<sup>1</sup>). Some more recent records were obtained in grabs and videos during pMCZ support surveys in 2015<sup>5&amp;6</sup>. Older records for Ocean quahog were acquired from DOE disposal grounds monitoring grab surveys (1990, 1997, 1998, 1999, 2000, 2001, 2002, 2003 and 2004<sup>2</sup>).</p> <p>Information on SS was derived from predicted habitat maps (2010, 2014<sup>4</sup>). PSA data confirming SS in the AoS were acquired from sediment samples collected in 2012<sup>3</sup>, 2014<sup>2</sup> and 2015<sup>5&amp;6</sup>.</p> <p>SPBM was recorded on video tows in two different surveys conducted in 2015<sup>5&amp;6</sup>.</p>				

### Source of data (Figure 4)

<b>Targeted data collection for nature conservation purposes</b>	✓	<b>Statutory monitoring (marine licensing etc.)</b>	✓	<b>Fisheries survey work</b>	X
<b>Data collection associated with development proposals (EIA etc.)</b>	X	<b>Recreational / volunteer data collection</b>	X	<b>Other (specify) – EUNIS predictive maps, PSA data</b>	✓
<b>Comments</b>	<p>The majority of the proposed feature records have been collected through targeted nature conservation-orientated surveys (DOE survey work 2015<sup>6</sup>; AFBI, 2015<sup>5</sup>; Ridgway <i>et al.</i>, 2012<sup>1</sup>).</p> <p>PSA data were obtained from sediment samples collected by DOE during several monitoring surveys. These were grabs collected as part of the disposal ground license programme<sup>2</sup> and Marine Coastal Access Act monitoring programme<sup>3</sup>. Additional PSA data was collected from AFBI cruise CO0715<sup>5</sup> and the DOE survey 2015<sup>6</sup>.</p> <p>The UK SeaMap 2010<sup>4</sup> predicted habitat map used in this assessment was developed by JNCC (McBreen <i>et al.</i>, 2011) and the EU SeaMap was developed by The European Marine Observation and Data Network (EMODnet, 2014)<sup>4</sup>.</p>				

Sampling methods / resolution							
Feature	Modelled	Acoustic / remote sensing	Remote video / camera	Infaunal - grab / core	Sediment sampling	Diving	Fisheries sampling
OQ			✓	✓	✓	✓	✓
SS	✓	✓	✓	✓	✓		
SS:SPBM			✓	✓	✓		
<b>Comments</b>	<p>A number of sampling methods have been used to collect information on the features of interest in the pMCZ.</p> <p>The predictive seabed habitat mapping projects UK SeaMap 2010<sup>4</sup> and EU SeaMap 2014 were developed by JNCC<sup>4</sup> (McBreen <i>et al.</i>, 2011; EMODnet, 2014) and provide us with modelled broad scale habitats in the pMCZ.</p> <p>Acoustic/remote sensing (side-scan sonar with single track bathymetry) has been undertaken by DOE (2015<sup>8</sup>) adding more information about the type of sediments in the pMCZ. AFBI have been involved in extensive multibeam mapping surveys of the North Channel-Irish Sea-Belfast Lough area.</p> <p>Remote video and photographic imagery sampling (using a drop-down spyball camera) has been undertaken by DOE across the pMCZ (RV Capitella), providing an overview of the composition and distribution of seabed habitats in the area<sup>6</sup>.</p> <p>Underwater camera techniques were previously used for OQ stock assessment based on the presence of the bivalve siphons on the seabed surface (Ragnarsson &amp; Thórarinsdóttir, 2002).</p> <p>Video tows were recorded by AFBI<sup>5</sup> (AFBI, 2015) using an Osprey camera and a GO-Pro camera in the southern area of the pMCZ (RV Corystes).</p> <p>Infaunal grab sampling has been used to provide a more detailed understanding of the quality, diversity and structure of the specific habitats<sup>1&amp;5</sup>. The PSA data for SS are from sediment samples collected in different surveys<sup>2,3,5&amp;6</sup>.</p> <p>Bangor surveys used a rigid-toothed dredge designed to equally sample all size classes of OQ greater than 25mm height, deployed from RV Prince Madog in different surveys<sup>1</sup> (Bangor University 2005, 2008a, 2008b, 2010).</p>						

Data coverage (Figures 3 to 6)							
<i>Across the pMCZ</i>							
Large numbers of proposed feature records distributed across pMCZ		Numerous proposed feature records scattered across the pMCZ with some clumping	✓	Numerous proposed feature records possibly with some clumping. Boundary not defined solely by recorded feature distribution		Few or isolated feature records - possibly clumped?	

<b>For Individual features</b>				
<b>Multiple records of individual features providing indication of extent and distribution throughout pMCZ?</b>	✓ OQ	<b>Few or scattered records of specific features making extent and broad distribution assessment difficult?</b>	✓ SS SS:SPBM	<b>Few or isolated records of specific feature records</b>
<b>Are acoustic remote sensing data available to facilitate the development of a full coverage predictive seabed habitat map?</b>	Yes – publically acquired multibeam, backscatter and side-scan data has been utilised in the production of detailed habitat maps for Outer Belfast Lough pMCZ. A detailed groundtruthing/habitat map is under development.			
<b>Comments</b>	<p><b><i>Ocean quahog (Arctica islandica) (OQ) (Figure 5)</i></b></p> <ul style="list-style-type: none"> <li>• 2005, 2008 &amp; 2010 Bangor University Ocean quahog grab survey<sup>1</sup> – The grab and dredge surveys conducted in June 2005, July 2008, September 2008 and April 2010 showed that the OQ population at Belfast Lough appears to be restricted to a small area at the mouth of the Lough. Total numbers of live OQ and dead shell were recorded for each tow (40 total tows). Where OQ was present grabs (20) were undertaken for quantitative assessment providing a population density of 4.5 individual m<sup>2</sup>. Relative abundance was found to be lower in autumn. The population age was estimated to range between 6 and 217 years old in the pMCZ.</li> <li>• 2014 Marine Recorder – There are some single records of OQ from dive surveys in the AoS, outside the proposed boundary to the south-east (2012) and south-west (1984) of the pMCZ recorded as part of the SSNI programme (Sublittoral Survey Northern Ireland). OQ was recorded in the diving data as occasional and rare on the <a href="#">SACFOR scale</a> (JNCC, 2014). There are also multiple records for the presence of OQ from DOE disposal grounds monitoring grab surveys<sup>2</sup> both inside and outside the proposed boundary (north and north-east of the boundary) (for the years 1990-1991, 1997-2005 and 2007-2009).</li> <li>• 2015 AFBI CO0715 cruise<sup>5</sup> – Analysis of infaunal grab samples found juveniles and dead shells of OQ at one of the sites sampled within the pMCZ (middle). Some of the shell debris was identified in the video footage as OQ.</li> <li>• 2015 DOE Outer Belfast Lough pMCZ survey<sup>6</sup> – 14 stations were surveyed by camera survey and sediment grabs showing siphon presence on the surface and shell debris in some of the sampling stations in the pMCZ. However, distribution of the species is likely to be significantly under-recorded because it is often missed by grab sampling while the surface signs of OQ within the sediment are difficult to identify from drop-down video footage (Lancaster <i>et al.</i>, 2014).</li> </ul> <p><b><i>Subtidal (sublittoral) sand (SS) (Figure 6)</i></b></p> <ul style="list-style-type: none"> <li>• 1990-2014 DOE North Channel disposal grounds monitoring programme<sup>2</sup> – There are two sampling stations in the AoS and inside the pMCZ (station F01). PSA analysis performed in 2014 classed (according to EUNIS/BGS (British Geological Survey) modified Folk class) the sediment as ‘gravelly muddy sand’ (EUNIS 5.2) inside the pMCZ and gravelly sand outside the pMCZ (to the north-east of the boundary).</li> <li>• 2010 UK SeaMap JNCC<sup>4</sup> – The habitat map predicts subtidal sand occur across</li> </ul>			

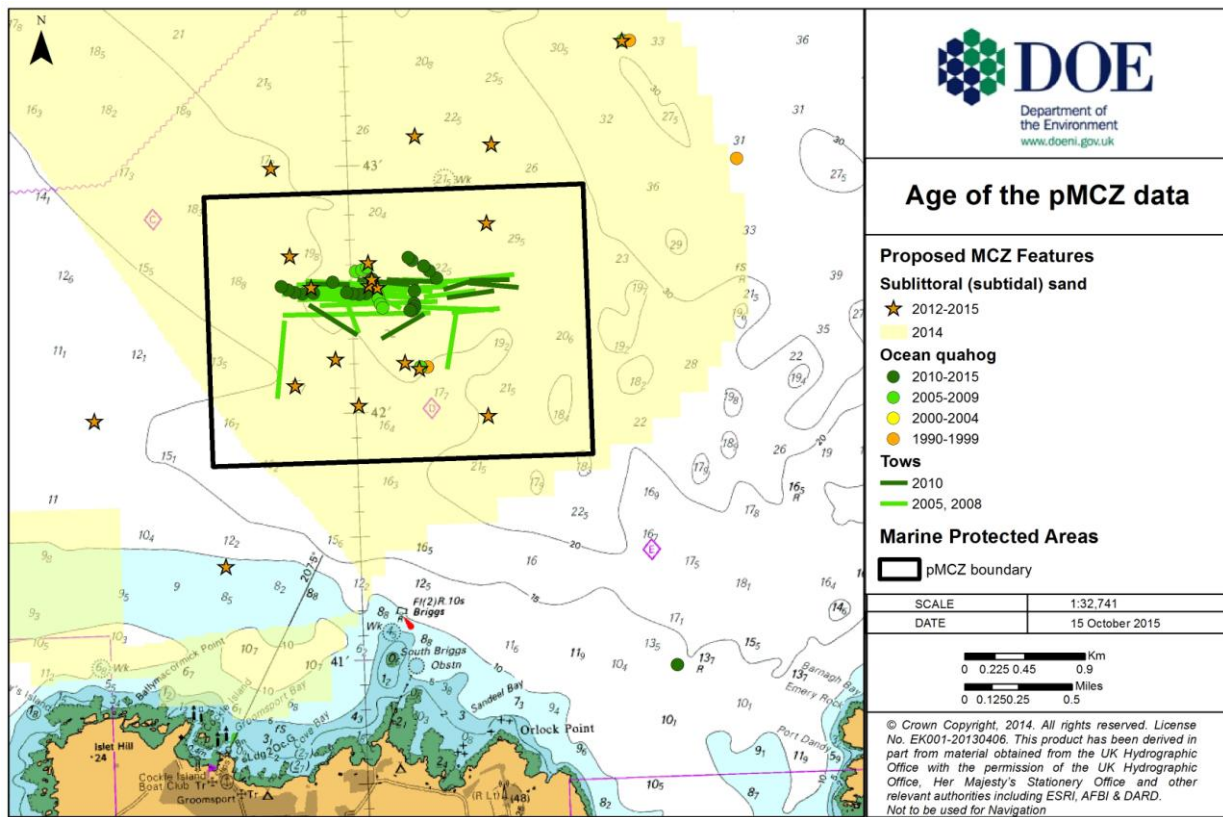
the entire pMCZ. Circalittoral fine sand ([SS.SSa.CFiSa](#) - A5.25), infralittoral fine sand ([SS.SSa.lFiSa](#) - A5.23), circalittoral muddy sand ([SS.SSa.CMuSa](#) - A5.26) and infralittoral muddy sand ([SS.SSa.lMuSa](#) - A5.24) are all predicted to occur in the area.

- 2012 DOE Belfast grab survey (Marine Coastal Access Act)<sup>3</sup> – PSA analysis of the two sample stations in the AoS to the south-west of the pMCZ boundary were classed as ‘gravelly muddy sand’ and ‘gravelly sand’ (EUNIS 5.2).
- 2014 JNCC EU SeaMap predicted habitat maps<sup>4</sup> – The habitat map predicts subtidal sand occur across the entire pMCZ. Circalittoral fine sand ([SS.SSa.CFiSa](#) - A5.25), infralittoral fine sand ([SS.SSa.lFiSa](#) - A5.23), circalittoral muddy sand ([SS.SSa.CMuSa](#) - A5.26) and infralittoral muddy sand ([SS.SSa.lMuSa](#) - A5.24) are predicted to occur in the area.
- 2015 AFBI CO0715 cruise<sup>5</sup> – Three sediment samples were collected during the survey and PSA was carried out. These grabs were collected in areas with high densities of OQ. All the sediments were recorded as ‘muddy sand’ (EUNIS 5.2).
- 2015 DOE Outer Belfast Lough pMCZ survey – There were 14 sediment samples collected by the Department in the AoS and pMCZ. PSA was carried out on all samples for sediment characterization. Of the 14 sediment samples, there were 12 records of ‘gravelly sand’ (EUNIS 5.2) and 2 records of ‘sandy gravel’ (EUNIS 5.1). Results are also consistent with the UK BAP Priority Habitat Descriptions for SS and gravels (JNCC, 2008).

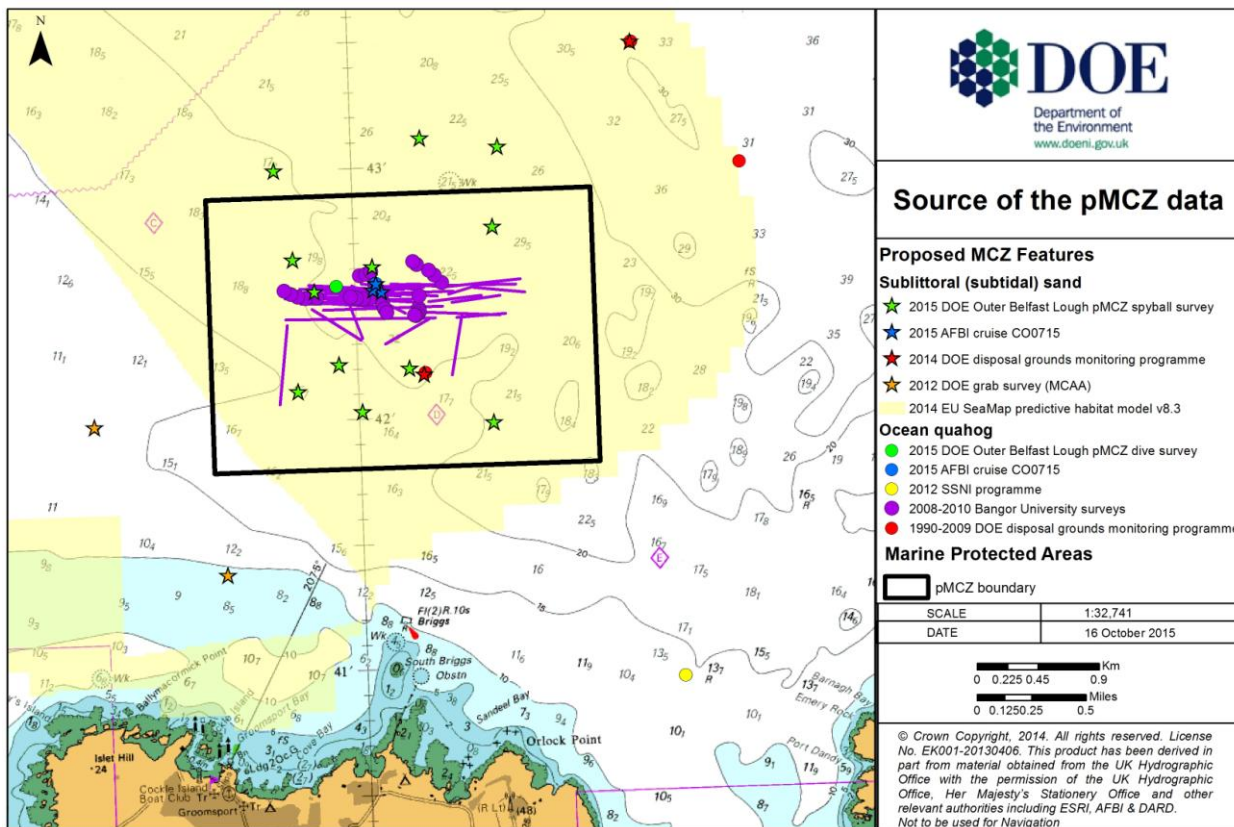
**SS: Sea-pen and burrowing megafauna communities (SPBM)**

- 2015 AFBI video tows and grab cruise CO0715 2015<sup>5</sup> – The tow deployed in this survey of the pMCZ recorded the presence of the biotope [SS.SMu.CFiMu.SpNMeg](#). Sea-pen *Virgularia mirabilis* was recorded in the tow (occasional on the [SACFOR scale](#) (JNCC, 2014)) together with *Nephrops norvegicus* burrows (common) and other smaller burrows.
- 2015 DOE Outer Belfast Lough pMCZ survey – 14 points within the AoS were filmed with a drop-camera remotely controlled from RV *Capitella* on 2015. The video footage was viewed using freeze-frame; slow motion and standard play speed as necessary to enable the identification of as many conspicuous species as possible and a determination of broad substrate type. The video footage showed clear burrowing activity in most of the stations sampled in the AoS. Burrows and mounds were recorded as frequent on the [SACFOR scale](#) (JNCC, 2014). Sea-pens were also identified in several stations inside the pMCZ.

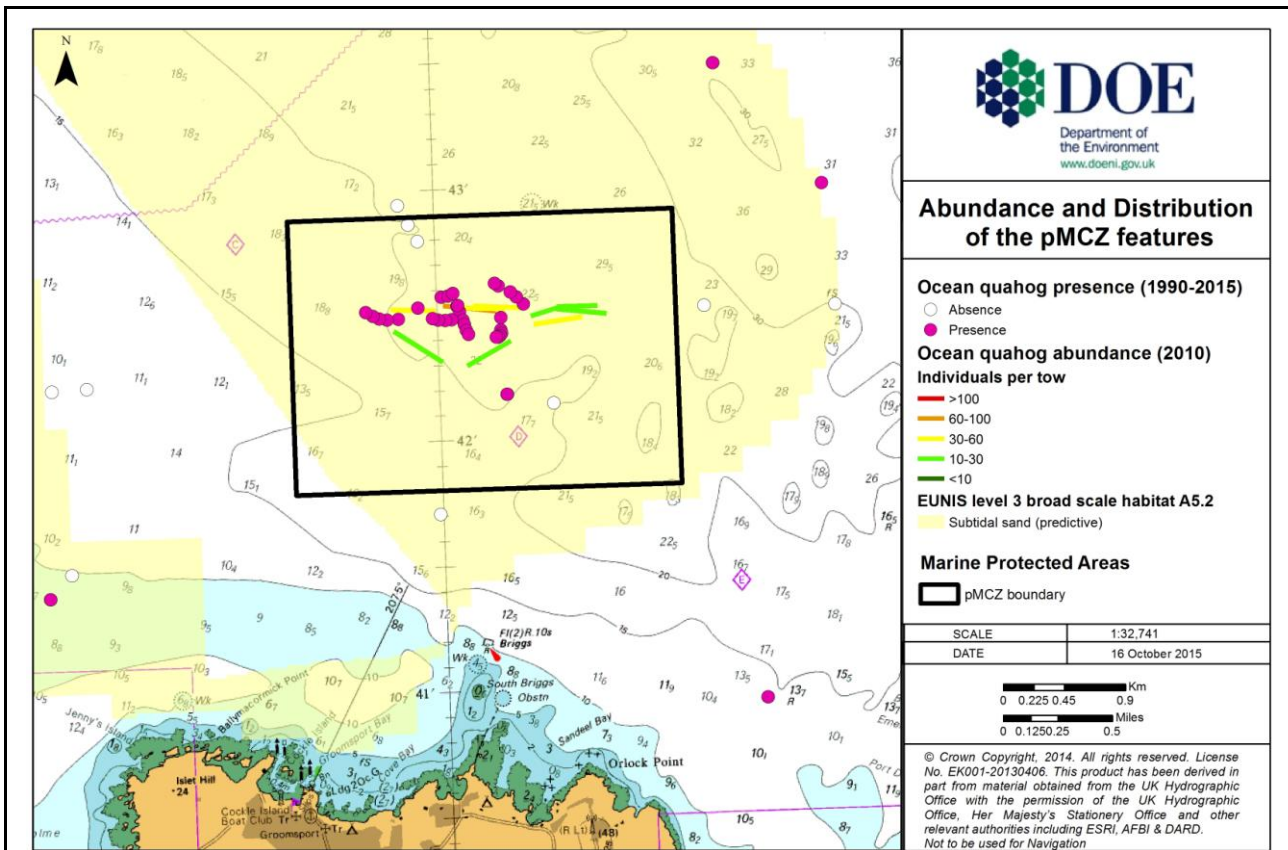
# The Evidence Base (Figures)



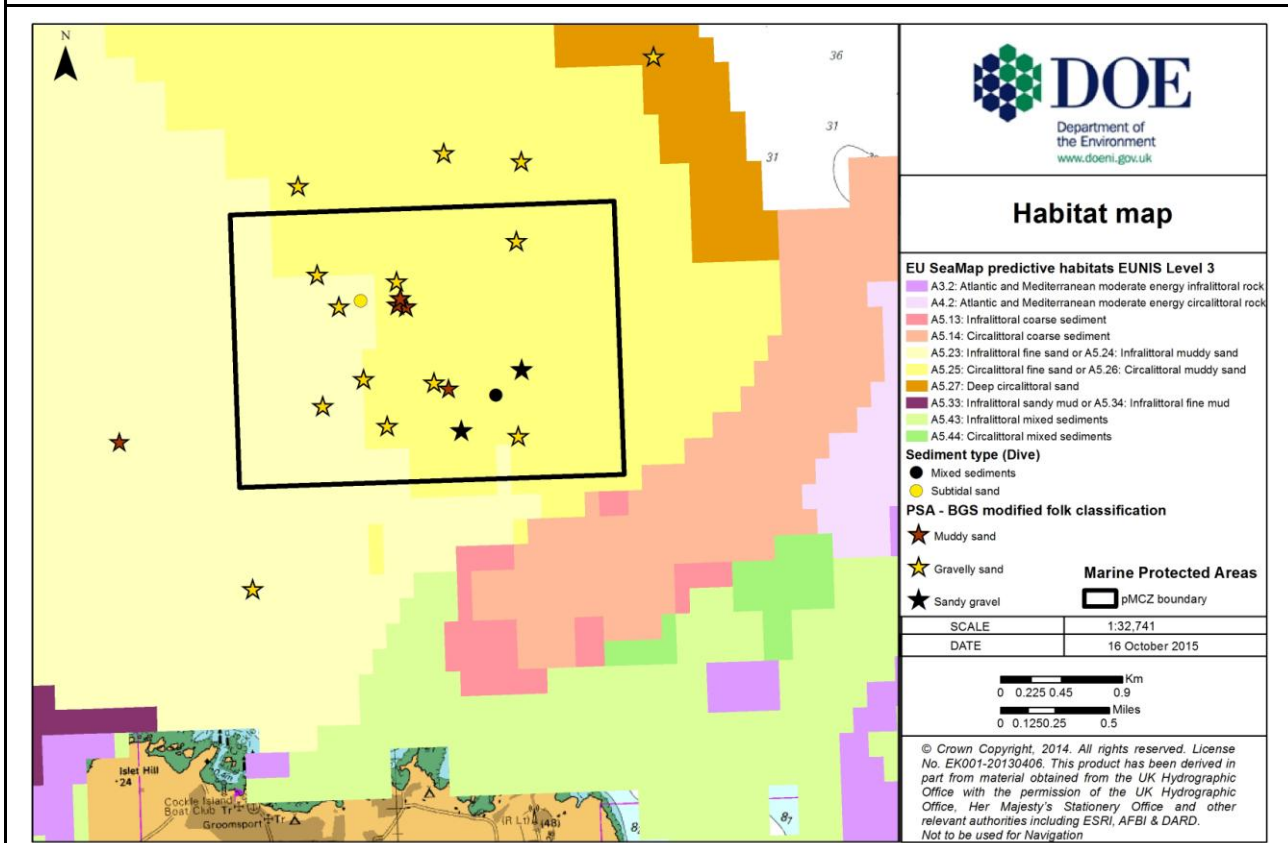
**Figure 3** Age of the feature data collected in Outer Belfast Lough pMCZ



**Figure 4** Source of the feature data collected in Outer Belfast Lough pMCZ



**Figure 5** Abundance and distribution of feature data collected in the Outer Belfast Lough pMCZ



**Figure 6** Habitat Map of Outer Belfast Lough pMCZ and surrounding seabed



Data sources and Bibliography		
Data Sources (used in assessment)	Reference	Features covered
<sup>1</sup> Bangor University Ocean quahog in Belfast Lough -grab and dredge surveys June 2005, July 2008, September 2008 and April 2010	Bangor University. <i>Arctica islandica</i> collection cruise Irish Sea and Belfast Lough. June 2005. Cruise report PD23/05 <a href="https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/6750/">https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/6750/</a>	OQ
	a.Bangor University. <i>Arctica islandica</i> collection cruise. Irish Sea and Belfast Lough. July 2008. Cruise report PD21/08 <a href="https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/8594/">https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/8594/</a>	
	b.Bangor University. <i>Arctica islandica</i> collection cruise. Irish Sea and Belfast Lough. September 2008. Cruise report PD30/08 <a href="https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/9122/">https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/9122/</a>	
	Bangor University. <i>Arctica islandica</i> collection cruise. Irish Sea and Belfast Lough. April 2010. Cruise report PD08/10 <a href="https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/10457/">https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/10457/</a>	
	Ridgway I. D., Richardson C. A., Scourse J. D., Butler P.G. and Reynolds D.J. 2012. The population structure and biology of the ocean quahog, <i>Arctica islandica</i> , in Belfast Lough, Northern Ireland. Journal of the Marine Biological Association of the United Kingdom, 92(03), 539-546. <a href="http://www.researchgate.net/publication/259419986_The_population_structure_and_biology_of_the_ocean_quahog_Arctica_islandica_in_Belfast_Lough_Northern_Ireland">http://www.researchgate.net/publication/259419986_The_population_structure_and_biology_of_the_ocean_quahog_Arctica_islandica_in_Belfast_Lough_Northern_Ireland</a>	
<sup>2</sup> DOE North Channel disposal grounds monitoring programme 1990-2014 (DOE-Marine Recorder database)	N/A	SS
<sup>3</sup> DOE Belfast grab survey (Marine Coastal Access Act) 2012	N/A	SS

Data sources and Bibliography		
Data Sources (used in assessment)	Reference	Features covered
<sup>4</sup> JNCC EU SeaMap predicted habitat maps 2014 v8.3 and UK SeaMap 2010	McBreen F., Askew N., Cameron A., Connor D., Ellwood H. & Carter A. 2011. UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters. JNCC Report, No. 446. <a href="#">EMODnet. EUSeaMap: A broad-scale physical habitat map for European Seas.</a>	SS
<sup>5</sup> AFBI cruise CO0715 - video tows and grab survey 2015	AFBI. 2015. Species and habitat data for Marine Conservation Zone Areas of Interest. Rathlin Island, Ballycastle Bay and Outer Belfast Lough. Report to the Department of the Environment.	OQ SS SPBM
<sup>6</sup> DOE Outer Belfast Lough pMCZ spyball surveys 2015 – drop-camera underwater video/still images, infaunal grab samples and Particle Size Analysis (PSA)	N/A	OQ SS SPBM
<sup>7</sup> DOE Outer Belfast Lough pMCZ diving survey 2015 – ground truthing	N/A	OQ SS SPBM
<sup>8</sup> DOE Outer Belfast Lough Side-scan sonar survey 2015	N/A	OQ SS SPBM
N/A	De Wilde, P.A.W.J., Berghuis, E.M. and Kok, A. 1986. Biomass and activity of benthic fauna on the Fladen ground (northern North Sea). Netherlands Journal of Sea Research. Volume 20, Issues 2–3, August 1986, Pages 313–323.	OQ
N/A	Hill, J., Pearce, B., Georgiou, L., Pinnion, J. and Gallyot, J. 2010. Meeting the MPA network principle of viability: feature specific recommendations for species and habitats of conservation importance. Natural England Report 043.	SS OQ
N/A	Hughes, D.J. 1998. Sea pens and burrowing megafauna (volume III). An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project).	SPBM
N/A	JNCC. 2014. Clarifications on the habitat definitions of two habitat FOCI: Mud habitats in deep water and sea-pen and burrowing megafauna. Peterborough, UK.	SPBM

Data sources and Bibliography		
Data Sources (used in assessment)	Reference	Features covered
N/A	JNCC. UK Biodiversity Action Plan. 2008. Priority Habitat Descriptions: Subtidal sands and gravels. From: UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock). <a href="http://jncc.defra.gov.uk/PDF/UKBAP_BAPHabitats-54-SubtidalSandsGravels.pdf">http://jncc.defra.gov.uk/PDF/UKBAP_BAPHabitats-54-SubtidalSandsGravels.pdf</a>	SS
N/A	Lancaster J. (Ed.), McCallum S., Lowe A.C., Taylor E., Chapman A. and Pomfret J. 2014. Development of detailed ecological guidance to support the application of the Scottish MPA selection guidelines in Scotland's seas. Scottish Natural Heritage Commissioned Report No.491. Ocean quahog Aggregations – supplementary document.	OQ
N/A	Natural England and JNCC. 2010. Ecological Network Guidance <a href="http://jncc.defra.gov.uk/PDF/100705_ENG_v10.pdf">http://jncc.defra.gov.uk/PDF/100705_ENG_v10.pdf</a>	SS OQ
N/A	OSPAR Commission. 2009. Background Document for ocean quahog <i>Arctica islandica</i> . <a href="http://www.ospar.org/documents/dbase/publications/p00407/p00407_ocean_quahog.pdf">http://www.ospar.org/documents/dbase/publications/p00407/p00407_ocean_quahog.pdf</a>	OQ
N/A	Ragnarsson, S.A. and Thórarinsdóttir, G.G. 2002. Abundance of Ocean quahog, <i>Arctica islandica</i> , assessed by underwater photography and a hydraulic dredge. Journal of shellfish Research, Vol 21., No. 2, 673-676, 2002.	OQ
N/A	Witbaard, R. and Bergman, M.J.N. 2003. The distribution and population structure of the bivalve <i>Arctica islandica</i> L. in the North Sea: what possible factors are involved? Journal of Sea Research 50 (2003) 11 – 25.	OQ



Department of the Environment  
Marine Division  
2<sup>nd</sup> Floor  
Klondyke Building  
Gasworks Business Park  
Belfast BT7 2AJ

Telephone: 028 90569262

Email:  
[MarineDivision.InfoRequests@doeni.gov.uk](mailto:MarineDivision.InfoRequests@doeni.gov.uk)

Photos represent Priority Marine Features  
found throughout the Northern Ireland  
Inshore Region

