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A new sand and gravel map for the UK Continental Shelf to support sustainable planning

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ABSTRACT

The planning framework for the UK Continental Shelf (UKCS) is undergoing significant change. An integrated plan-led process, similar to that undertaken onshore, is now being applied offshore. It is vital that marine mineral resources are adequately considered in this process. In order to facilitate this, the first ever sand and gravel mineral resources map of the entire UKCS has been created.

Offshore resources have been defined by integrating geological mapping data and the British Geological Survey's extensive collection of core, sea bed sample and geophysical records. A spatial model has been developed that highlights the location and likely composition of sand and gravel deposits with the results undergoing geological review to ensure different sea-bed features have been adequately represented. Results are presented as a series of four maps covering the entire UKCS.

With increasing pressure on marine space it is important to balance the competing demands and needs from different use sectors. Identification of the distribution of sand and gravel resources at a national scale and presentation in a consistent fashion allows planners to adequately consider minerals in the planning process and permits more effective and sustainable sea-use management strategies to be developed.

1. Introduction

Sand and gravel deposits consist of accumulations of durable rock fragments and mineral grains that have been derived from the weathering and erosion of bedrock, mainly by glacial and fluvial processes, but also by marine and wind erosion. On the UKCS most economic resources of sand and gravel are composed of particles that are rich in silica (quartz, quartzite and flint).

Most offshore sands and gravels on the UKCS have similar origins to their land-based equivalents. Many of these marine aggregate resources are relict deposits that were formed during times when the sea level was much lower than at present. During these periods large parts of the modern sea bed were exposed, glaciated or crossed by major river systems. In contrast to land-based deposits, deposits can also be formed where modern marine processes have concentrated sand and gravel into surface features, such as sand banks.

Marine sands and gravels form an important part of the supply chain of construction materials. The UK has one of the largest construction aggregate dredging industries in the world providing 24% (10.2 million tonnes) of the UK's annual consumption of sand and gravel in 2012 (Bide et al., 2014). The supply of marine sand and gravel is especially important in major urban centres, such as London, where 50% of the sand and gravel required by construction projects is supplied from offshore (The Crown Estate, 2014). Here it can be landed at city wharves very near to the market, reducing costs and energy intensive road transportation associated with land-based resources.

Demand for these offshore mineral resources is unlikely to decline in the future as the UK develops. Possible major infrastructure projects such as new power stations and transportation hubs all need large volumes of sand and gravel. The effects of climate change will also cause an increased demand as more material is required for coastal defences. These high levels of demand combined with ever increasing competition for uses and designation of the sea bed from, for example, renewable energy installations, fishing, pipelines, marine protected areas, etc. all have the potential to restrict supply. As a result it is vital to ensure offshore resources are planned sustainably and effectively, utilising the best available information.

A lack of suitable spatial data for inclusion in the planning process for marine mineral resources has necessitated the creation of marine

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mineral resource maps and corresponding digital data. The maps and data created by this research contain comprehensive information on the location and properties of offshore sand and gravel resources. This information will aid in the sustainable use of, and facilitate the planning for, these materials (Bide et al., 2013).

1.1. UK planning for marine sand and gravel

Historically, there has been limited marine planning which has been approached on a sectoral basis, considering planning issues at the level of individual project or permits. For example, in the UK, for over 20 years, some sectors have been applying an Environmental Impact Assessment (EIA)-based approach voluntarily. This has been the case for marine dredging. This has meant that decisions were made in isolation sometimes leading to conflict between different sectors utilising the sea bed (e.g. fisheries, mineral extraction, energy, infrastructure). The impact of different economic sectors and marine protected areas on one another and the resultant conflict, as well as a lack of communication between responsible bodies, indicated a clear need for a more integrated spatial planning framework for the use of marine space (Douvere, 2008). Historically, such communication was the responsibility of industry bodies. In the UK some sectors, such as marine aggregate extraction, developed best practice guidance and liaison protocols (for example, in relation fisheries and archaeological finds) to mitigate such conflicts as much as possible (Newell and Woodcock, 2013).

Marine spatial planning has evolved and grown as a concept over the last 15 years. Initially it involved the creation of marine protected areas where the main purpose was for the protection of ecosystems against anthropogenic pressures as, for example, the Great Barrier Reef or the Florida Keys. In the UK, consideration of the protection of the marine environment in this way began with the UK Habitats Directive 1994, (Statutory Instruments 1994 No. 2716) following on from the EU Habitats Directive of 1992 (Council Directive 92/43/EEC). More recently, however, it has begun to be used where there are multiple (potentially conflicting) uses of marine space with great economic as well as environmental value, that need to be carefully balanced and managed to avoid potential conflict, as for example in the North Sea (Douvere, 2008).

In the UK the process of marine spatial planning began with the Marine and Coastal Access Act 2009 (HM Government, 2009), the Marine (Scotland) Act 2010 (Scottish Government, 2010) and the Marine Act (Northern Ireland) 2013, which introduced a new system for marine planning and licensing. The Acts are very relevant to mineral resources, not only altering the way exploration and extraction are licensed but also representing a significant change from a sectoral-based permit system to a more holistic plan-led one. For England a new body, the Marine Management Organisation (MMO), has been created and tasked with formulating spatial plans and associated policies. The Scottish Government, Welsh Government and Department of Environment for Northern Ireland are responsible for this in their respective marine areas.

The Acts paved the way for the UK-wide marine policy statement announced in March 2011 (HM Government, 2011). This document set the framework for the preparation of marine plans in the UK under the guidance of the MMO and respective counterparts for Wales, Scotland and Northern Ireland. These plans, being developed at the time of writing, will provide detailed, coherent policy and associated spatial guidance for marine activities. With regard to marine sand and gravel the marine policy statement specifically states that plans should ensure provision for the long-term supply of sand and gravel and take into account the need to safeguard mineral resources from sterilisation by other forms of development. This is explained in much more detail in section 3.5.5 and 3.5.6 of the policy document (HM Government, 2011).

Consideration of minerals issues in spatial planning is not new in the UK. Protection of mineral resources to ensure adequate and steady supply is already undertaken in the UK onshore planning system. The National Planning Policy framework (NPPF) contains several specific policies regarding minerals issues (DCLG, 2012).

The marine policy statement also recognises that minerals can only be worked where they occur, which is a key difference between minerals planning and many other forms of land-use planning. As a result, in order to secure the adequate and steady supply of marine sand and gravel there is a need to ensure that sterilisation of mineral resources is adequately considered during the determination of applications for other forms of offshore development, such as wind farms, oil and gas platforms, ports, pipelines and the laying of cables. Such developments if located on, or near, mineral resources will prohibit their future extraction.

The process of mineral safeguarding is one method to prevent such sterilisation. Safeguarding forms a key part of onshore spatial minerals planning (DCLG, 2012), and as one of the goals of the new marine planning system is to better align onshore and offshore planning, the principles of mineral safeguarding can be applied offshore. Consequently mineral safeguarding policies have been included in the first marine spatial plan for the East Coast (MMO, 2014).The mineral safeguarding process involves recognising that a mineral resource is present by using spatial minerals information to formulate suitable polices and then to appropriately manage any planning applications for development to ensure that the mineral resource is not needlessly sterilised (Wrighton et al., 2011).

1.2. International approaches to spatial planning for marine sand and gravel

Marine spatial planning is now a well-established process (Douvere, 2008). However, consideration of issues regarding offshore sand and gravel resources are often poorly represented in the plans of many responsible bodies. Typically this is due to the small-scale nature of the marine sand and gravel industry in many countries. The inclusion of mineral related policies in the UK marine policy statement and prominence given in MMO marine plans to offshore sand and gravel resources exhibits the importance of the marine aggregate sector in the UK and the significance it has in UK aggregates supply, when compared to other nations.

One of the first significant steps in marine spatial planning in the EU was the adoption of an integrated maritime policy by the European Parliament in 2007 (European Parliament, 2007; Hull, 2013). This policy aims to increase coordination between EU member states by the introduction of different key policy areas. This has relevance to marine sand and gravel extraction as sustainable growth in marine industries, termed ‘blue growth’, has been highlighted as one of these key policy areas (European Parliament, 2012). The integrated maritime policy paved the way for The Marine Strategy Framework Directive (Directive 2008/56/EC), which set the agenda for marine spatial planning in the UK. The Directive prescribes an ecosystems-led approach with the aim of lowering pressure on natural marine resources and marine ecological services (European Parliament, 2008). This is a high level document outlining the need for EU- wide protection of marine ecosystems and does not specifically mention any industrial sector, but focuses on how to mitigate against damage. This is a common theme in many marine policy documents in that dredging for marine sand and gravel is only mentioned in relation to the potential damaging effects of dredging as opposed to the importance of these natural resources in their own right. This is the case for Portugal’s spatial marine plan (Carneiro, 2007), and for regional marine spatial plans for the USA (NOAA, 2014). However, for the