Supporting **I**mplementation of **M**aritime Spatial Planning in the **Celt**ic Seas

Component 1: Supporting Implementation of MSP

Component 1.1. Initial Assessment – Developing an Overview

Deliverable 1: Summary Information on Marine Aspects of the Celtic Seas

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Editors (in alphabetical order): Alloncle, N., Ansong, J., Fairgrieve, R., Fisher, C., Jay, S., Le Lievre, C., McGowan, L., Nic Aonghusa, C., Nixon, E., O'Hagan, A.M., Rooney, A. and Ross, L..

Contributors (in alphabetical order): Ansong, J., Le Lievre, C., MacMahon, E., O'Hagan, A.M. and O'Higgins, L.A..

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Table of Contents

List of Figures

List of Tables

Glossary of Terms

AIS - Automatic Identification System

ATBAs - Areas to be Avoided

BIC-British Irish Council

CSF - Celtic Seas Front

CFP - Common Fisheries Policy

CBA - Cost Benefit Analysis

COM - Communication

DAERA - Department of Agriculture, Environment and Rural Affairs

DEFRA – Department of Environment Food and Rural Affairs

DCCAE - Department of Communication, Climate Action and Environment

DG-MARE - Directorate-General for Maritime Affairs and Fisheries

DIRM NAMO – Direction Interrégionale de la Mer Nord Atlantique Manche Ouest

EBA – Ecosystem-based approach

EEA - European Environment Agency

EC- European Comission

EMFF - European Maritime Fisheries Fund

EU - European Union

EUNIS - European Nature Information System

EEZ – Exclusive Economic Zone

HABs - Harmful Algal Blooms

HOOW - Harnessing Our Ocean Wealth

MMO- Marine Management Organisation

MSP- Maritime/Marine Spatial Planning

ICC – Irish Coastal Current

ICES - International Council for the Exploration of the Sea

IMO - International Maritime Organisation

IMP - Integrated Maritime Policy

ISF - Irish Sea Front

IF - Islay Front

MFD – Maritime Front Document

MSDI - Maritime Spatial Data Infrastructure

MSF - Mid-Shelf Front

MSFD – Maritime Strategy Framework Directive

MS-Member State

NAMO- North Atlantic and Western Channel

NGO - Non Governmental Organisation

Ratione Materiae – Material scope

ROFI - Region of Fresh Water Influence

ODEMM - Options for Delivering Ecosystem-Based Marine Management

OSPAR – Oslo and Paris Comissions

PFOW - Pentland Firth and Orkney Waters

SA- Sustainability Appraisal

SCC - Scottish Coastal Current

SEA – Strategic Environmental Assessment

SEC - Shelf Edge Current

SOLAS – Safety of Life at Sea

TPEA - Transboundary Planning in the European Atlantic

TSSs - Traffic Separation Schemes

UCG - Underground Coal Gasification

UNCLOS – United Nations Convention on the Law of the Sea

WNMP – Welsh National Maritime Plan

UF - Ushant Front

1. Introduction

The purpose of this report is to initiate an investigation into the challenges and opportunities associated with the implementation of Maritime Spatial Planning (MSP) in transboundary areas of the Celtic Seas. As a foundation of understanding, this document provides an overview of the territiorial boundaries and key environmental characteristics of the region; major maritime activities; key sectoral and socio-economic trends and pressures and relevant European policy and legislation with a bearing on MSP and transboundary working. The report also aims to give relevant insight on pre-existing cross-border stakeholder fora providing a basis for continued cooperation and engagement on maritime issues and a summary of previous transboundary maritime spatial planning initiatives for the Celtic Seas region.

1.1. Background and context

The regulation of maritime activity in Europe's regional seas is governed by two overarching policy initiatives; the Integrated Maritime Policy (IMP; EU 2007) and the Marine Strategy Framework Directive (MSFD; 2008/56/EC). The IMP encourages holistic, cross-sectoral regulation of all elements of maritime activity while the MSFD serves as its environmental pillar placing a legal requirement on Member States (MS) to restore degraded ecosystems to Good Environmental Status (GES) by 2020. Recently, a European Council communication entitled Blue Growth: opportunities for marine and maritime sustainable growth (EU 2012), and subsequent related actions (EU 2013a, b & c; EU 2014; EU 2017) have placed a strong emphasis on the expansion and diversification of the recently coined, Blue Economy. Growth in the Blue Economy is currently viewed as a means of steering the EU out of its current economic crisis (EU, 2017) and reflects a wider global trend of accelerated maritime activity set against a backdrop of rapidly increasing global population and demand for new sources of food, energy and minerals. In an effort to ensure that this growth proceeds in an environmentally responsible and economically sustainable manner, in 2014, the European Council adopted the Maritime Spatial Planning (MSP) Directive [2014/89/EU] placing a statutory obligation on all coastal MSs to develop transparent, cross-sectoral and spatially specific maritime spatial plans to manage human activities in their territorial waters by March 2021.

In the broadest terms, Directive 2014/89/EU defines MSP as a process by which . . . *relevant Member States authorities analyse and organise human activities in marine areas to achieve ecological, economic and social objectives.* As a starting point, national maritime plans must address four key industrial sectors: the environment, fisheries, transport and energy, with permission to add additional sectors as plans develop. Given the fluid, three-dimensional nature of the marine environment, the high degree of spatial overlap between maritime sectors and the mobility inherent to many maritime activities, coastal MS must apply a coordinated, integrated and transboundary approach to ensure coherent and coordinated plans for the entire marine region concerned. Thus while the development of national MSPs are the ultimate responsibility of individual MS, those sharing a maritime boundary must consult with neighbouring states' and coordinate their planning efforts to ensure that the collective pressure of all maritime activities stays within levels compatible with the achievement of GES. Transboundary plans must therefore take account of land-sea interactions, potential cumulative and/or downstream effects and, where necessary, include the development of integrated sea-basin or macro-regional strategies.

To this end both the MSFD and MSP Directives advocate a holistic Ecosystems Based Approach (EBA) to marine resource management, replacing the previously fragmented, sector-based system of decision-making with a "total ecology" approach to the management of all maritime activities (Farmer, 2012; Mee,

2015). According to the definition given by the Ontario Ministry of Natural Resources (OMNR, undated), such an approach integrates [..] *connections between land, air and water and all living things, including people, their activities and institutions* and provides a means of mapping and assessing cumulative, downstream and far-field pressures that can span neighbouring maritime jurisdictions. Moreover, through advocating use of the EBA, the MSP Directive is often viewed as a cross-cutting policy tool enabling simultaneous implementation of socio-ecological and economic objectives common to the IMP, the MSFD and the Blue Growth agenda. Achieving a sustainable balance between national economic ambitions and the environmental pressures attendant with these on the one hand, with ensuring GES and ocean health on the other, is a complex challenge. According to *The Economist* Blue Economy report (2015) however, MSP offers a path for considering these as compatible propositions provided an integrated governance structure and set of supporting conditions are present. As a minimum, these include good laws, strong institutions, inter-ministerial cooperation, inclusive decision making processes involving all stakeholders, evidence-based support and credible arbitration processes. Within the Celtic Seas region, uncertainty emerging from Brexit and the potential effects this will have on transboundary co-operation (Hull 2016) adds a further dimension of complexity and one that will require continued commitment to regional cross-border cooperation across governance levels and maritime sectors.

The Celtic Seas represents a subregion of the larger North East Atlantic region and spans the sovereign and/or jurisdictional waters of Ireland, France and the United Kingdom. Within UK waters, further delimitation occurs within and between the devolved administrations of Scotland, Northern Ireland, England and Wales, the Crown dependencies of Jersey, Guernsey and the Isle of Man and neighbouring MS. To date, these waters have been the subject of numerous EU-funded studies examining the requirements of transboundary working primarily in relation to the MSFD e.g. ODEMM[1], PISCES[2] and the Celtic Seas Partnership[3], with a single study, the Transboundary Planning in the European Atlantic (TPEA) project[4] focussing specifically on common approaches to cross border MSP. Collectively these form an important basis of understanding of the key obstacles and enablers to transboundary cooperation for the region providing valuable insight, experience, tools and approaches that are readily transferable to the SIMCelt process. For example, in their analysis of the main challenges to the implementation of the EBA in the Celtic Sea, the PISCES project (2012) cited i) institutional complexity; ii) independent fisheries management; iii) divergent policy implementation tools and timetables; iv) wide distribution of stakeholders; and iv) the lack of ecologically robust targets as key obstacles. Similarly, at the broader European level, several investigators have cited clearly-defined and mutually acceptable targets and compatibility in the timing and objectives of neighbouring states' spatial plans as key enablers to the development of concrete cross-border cooperation on MSP (Erg et al. 2012; Jay et al. 2016; Zaucha 2016).

Overcoming these challenges will require close collaboration and cooperation across governance levels between neighbouring jurisdictions, exploring common approaches and addressing genuinely transboundary issues with the aim of supporting full integration of an EBA to the planning process. This is all the more pressing given the increasing demand for maritime space for various purposes, such as installations for the production of renewable energy, oil and gas exploration and exploitation, maritime

[1] ODEMM: Options for Delivering Ecosystem-Based Marine Management. Retrieved from http://odemm.com/

[2] PISCES – Partnerships Involving Stakeholders in the Celtic Seas Ecosystem. Retrieved from http://awsassets.wwf.es/downloads/pisces_project_lyndsey_dodds.pdf

[3] CSP: Celtic Seas Partnership. Retrieved from: http://celticseaspartnership.eu/

[4] TPEA: Transboundary Planning in the European Atlantic. Retrieved from http://www.tpeamaritime.eu

shipping, fishing activities etc. and the array of attendant environmental pressures this brings. Transboundary ecosystems-based MSP however offers a potential path for considering economic development and environmental protection as compatible propositions (Ebarvia 2016) and to this end the MSP Directive requires national authorities to: i) take account of land-sea interactions, ii) possible adverse cumulative and/or downstream effects of human activities on ecosystem functioning and iii) cooperate with MS and third countries with bordering marine waters. Thus while the development of national MSPs are the ultimate responsibility of individual MS, in accordance with the United Nations Convention on the Law of the Sea (UNCLOS), Directive 2014/89/EU requires MSs sharing a sea boundary to cooperate with the aim of ensuring that maritime spatial plans are coherent and coordinated across the marine region concerned.

As stated in the MSP Directive, transboundary co-ordination may be pursued through: (a) existing regional institutional cooperation structures such as Regional Sea Conventions; and/or (b) networks or structures of Member States' competent authorities; and/or c) any other method that might ensure coherent and coordinated planning across the marine region. Efforts within SIMCelt aim to support the development of such cooperation in the Celtic Seas region and will contribute to the implementation of the Maritime Strategy for Atlantic Ocean Area (European Commission, 2011a) and the associated Action Plan (European Commission, 2013a). By building dialogue and concrete cross-border cooperation, the SIMCelt partners are working together to share best practices and facilitate cross-border cooperation on MSP as specified under Priority 2 of the Action Plan for the Atlantic Area specifically to protect, secure and develop the potential of the Atlantic marine and coastal environment.

1.2. The SIMCelt Project

SIMCelt - Supporting Implementation of Maritime Spatial Planning in the Celtic Seas is a two-year €1.8 million project co-financed by DG Mare and focussed on promoting the development of transnational cooperation to support the implementation of EU Directive 2014/89/EU in transboundary zones of the Celtic Seas. Led by University College Cork, the SIMCelt consortium comprises maritime spatial planners and researchers from seven partners representing a mix of governmental authorities and academic institutes from Ireland, France and the UK. In order to develop this cooperation, SIMCelt will be practitioner focused and seek to identify and share best practice on technical, scientific and social aspects of MSP. This initial assessment therefore provides an overview of maritime activities, MSP relevant legislation and institutional competencies across the entire Celtic Seas region and serves as a foundation of understanding to subsequent sub-components (Fig. 1) to examine in greater detail and at appropriate spatial scales, planning activity at specific cross-border locations.

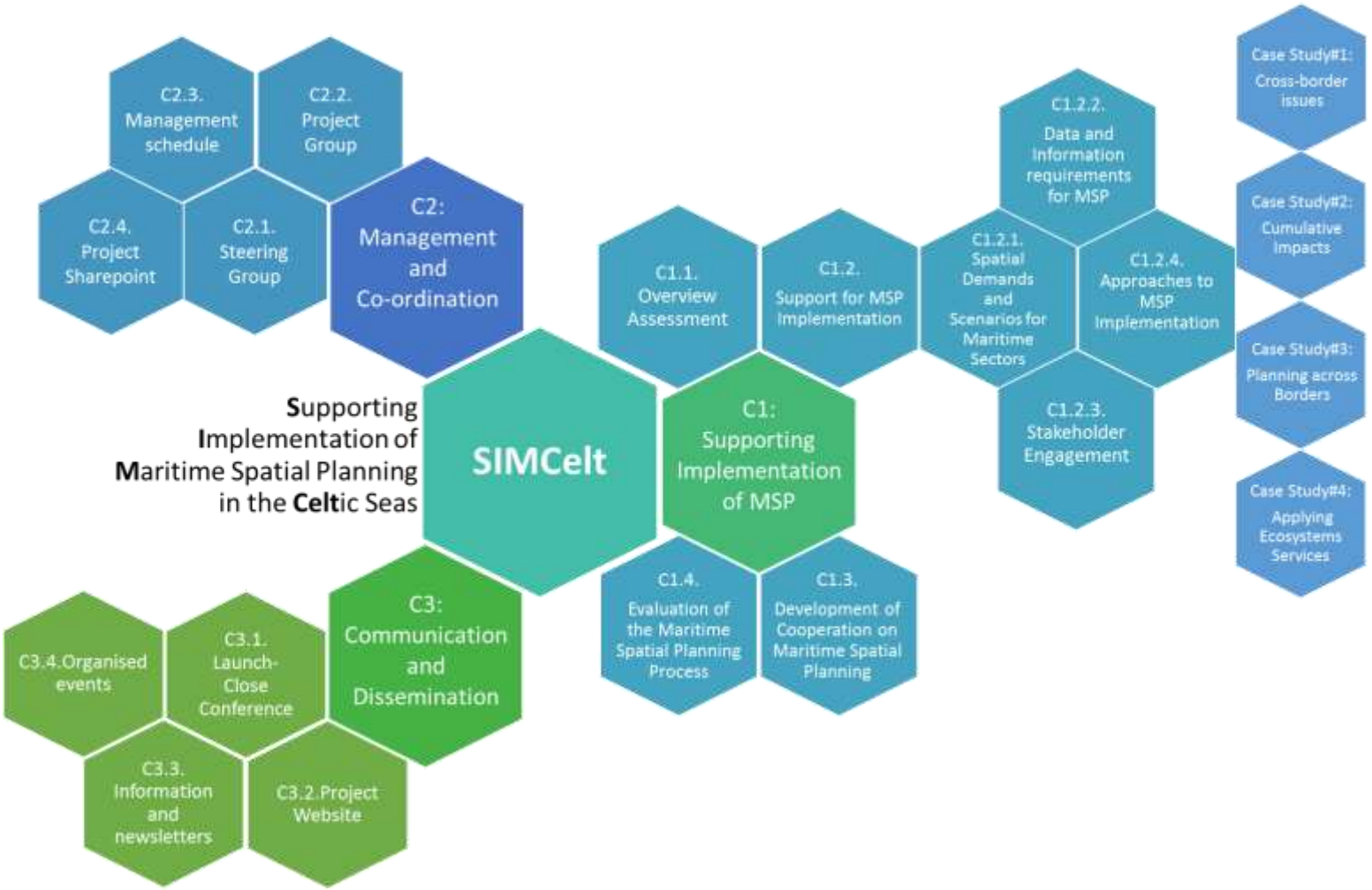

Figure 1. Primary components and sub-components comprising the SIMCelt project encompassing technical, scientific and social elements relevant to the development of a transboundary planning process in the Celtic Seas. Included are a series of four cases studies addressing priority issues identified by national planning authorities and designed to complement and extend the work undertaken in C1.2.1 – C1.2.4.

1.2.1. Objectives of the SIMCelt project

To meet the objectives of the European Commission's call on Maritime Spatial Planning in the Northern European Atlantic SIMCelt will focus on the two key objectives:

1. Provding support for the implementation of the Directive on Maritime Spatial Planning in Member States' marine waters; and
2. Launching and carrying out concrete, cross-border MSP cooperation between Member States in the Northern Atlantic, involving at least two Member States and the relevant authorities responsible for MSP in the selected area.

To achieve these objectives, SIMCelt will focus on a number of activities that reflect and respond to perceived planning priorities as identified by national MSP authorities directly involved in the project and whose remit impacts in the Celtic Seas. These proposed activities can thus be summarised under the following objectives and indicators.

Table 1. SIMCelt project objectives and key performance indicators of project activities

Specific Objective	Indicator
1. Inform awareness and understanding of the range of factors potentially impacting on the marine area within the Celtic Seas, their likely cumulative impact and projected future trends.	Provide a description of existing conditions and activities, trends and impacts.
2. Building on existing mechanisms, identify opportunity and best practice for data sharing and joint use of data; within the specific context of transboundary areas and issues within the Celtic Seas.	Enhance the exchange of data and the interoperability of maritime spatial data mechanisms. Provide a document summarising examples of good practice in relation to specific aspects of MSP implementation relevant to transboundary areas and issues.
3. Identify and address important data gaps and support the coherence of data analysis across marine area boundaries.	Integrate new data sources to existing data systems.
4. Examine the potential impact and interaction of maritime sectoral activities, specifically where they span marine area borders.	Collate sectoral information relating to future trends and priorities.
5. Explore the potential spatial requirements for marine conservation; specifically the challenges around transboundary working.	Describe the extent and impact of current and potential future marine protected areas on the MSP decision making process.
6. Examine the challenges to, and opportunities for, transboundary cooperation on MSP and possible approaches to addressing these.	In specific localities, scope the challenges and opportunities for transboundary cooperation and test innovative ways of working.

Building on the outputs of previous transboundary MSP initiatives and using a combination of desk-based research, stakeholder engagement activities and issue-specific case-studies outlined in Fig. 2, SIMCelt will identify pathways to enhance cross-border cooperation on MSP in the Celtic Seas region. Specifically, we will assess spatial use demands for each maritime sector identified in the MSP Directive and examine the role of national and European conservation strategies in ensuring the sustainable future development of these sectors (C1.2.1). Central to the success of these and related SIMCelt activities, the availability of high quality spatial data will be assessed through a systematic evaluation of existing data sources, gaps and issues surrounding the spatial inter-operability of available data and the accessibility of this data through delivery of a Celtic Seas-specific SIMCelt data portal demonstrator (C1.2.2). In support of good practice in stakeholder engagement, SIMCelt will also evaluate various approaches to co-operative transboundary working and build on the experiences of partners to date to improve understanding of localised cross-sectoral challenges to transboundary MSP (C1.2.3).

Developing on these components, a series of issue-specific case studies (C1.2.4.) will be established to: 1. Identify common strategic planning objectives spanning maritime borders (Case Study 1), 2. Assess the potential cumulative impacts of multiple use pressures on ecosystems service delivery (Case Study 2), 3. Enhance cross-border dialogue and co-operation to ensure coherent cross-border planning in selected transboundary locations (Case Study 3), and, 4. Develop an Ecosystems Based management tool for the evaluation of key ecosystems services (Case Study 4). Finally, we will explore potential mechanisms for supporting cross-border cooperation between planning authorities (C1.3) and examine various approaches currently being taken by Member States to the evaluation of the MSP processes (C1.4, ultimately providing a foundation of understanding on which support for implementation of transboundary MSP in the Celtic Seas can be developed.

2 The Legal Framework for Maritime Spatial Planning

The development of MSP in the Celtic Seas region has received an important impetus from a number of earlier EU policies and legislation. Along with the MSP Directive, the most important drivers for co-ordinated management of the marine enviornment are the Integrated Maritime Policy, the Marine Strategy Framework Directive (MSFD), the Birds Directive (2009/147/EC) and Habitats Directive (92/43/EC), the Renewable Energy Directive (2009/28/EC), the Strategic Environmental Assessment Directive (2001/42/EC) and the Environmental Impact Assesment Directive (85/337/EEC). Legal instruments related to the implementation of these have had a significant impact on the allocation of marine spaces most notably by requiring a more integrated approach to governance at sea, the designation of networks of marine protected areas and the assessment of the influence of maritime activities on the marine environment. The primary objective of the MSP Directive therefore is to provide the general framework for enhanced coordination between these sectoral EU policies and legislation. The existing corpus of EU policies and legislation outlined below is thereby relevant to the implementation of the MSP Directive and provides support to planners developing integrated management approaches for MSP within the Celtic Seas region.

2.1. The Maritime Spatial Planning Directive

Directive 2014/85/EU establishing a framework for maritime spatial planning (Maritime Spatial Planning Directive) provides a firm legal footing for national and transboundary maritime spatial planning initiatives, with EU Member States required to set up maritime spatial plans at the latest by 31st March 2021. The purpose of the MSP Directive is to promote the sustainable growth of maritime economies, the sustainable development of the marine area and the sustainable use of marine resources (Article 1). The MSP Directive is characterised by its integrative aspect. As mentioned before, the objective of the MSP Directive is not to replace previous Directives and policies but rather to promote better coordination between EU sectoral sea-related policies. The Directive is not sector-specific and covers all policy areas of the Treaty on the Functioning of the European Union (European Union, 2008) which have an impact on coasts, seas and oceans and serves as a cross-cutting policy tool.

The obligations set for Member States are mainly procedural and affect plan-making processes rather than the substantive content of maritime spatial plans. The main requirement is the obligation on Member States to develop maritime spatial plans which identify the spatial and temporal distribution of relevant existing and future activities (Article 8), taking into account economic, social and ecological aspect and applying an ecosystem-based approach. The specifics of implementation regarding the content of maritime spatial plans and sectoral priorities to be pursued in national MSP systems are left to the competence of Member States (see Article 5(3), Article 6, Article 8(2)).

The added value of the Directive exists where it imposes a hard obligation in EU law to implement maritime spatial planning (Article 4), to comply with common minimum standards and a common timeframe for the preparation and revision of maritime spatial plans (Article 6, Article 15). Member States are further bound by an obligation to cooperate with the 'aim of ensuring' that maritime spatial plans are coordinated and coherent across marine regions (Article 11). The wording of article 11 shall be interpreted as a strict obligation to cooperate on cross-border maritime spatial planning issues. However, if cross-border cooperation is mandatory, the insertion of 'with the aim of ensuring' under article 11, shall not be interpreted as imposing a binding requirement to ensure that maritime spatial plans are effectively coordinated, coherent across borders.

2.2. Integrated Maritime Policy

MSP is a direct product of the Integrated Maritime Policy (European Commission, 2007). Recognising that compartmentalised policies and decision-making is no longer suitable to promote maritime economies and address cumulative impacts on marine ecosystems, the Integrated Maritime Policy and the accompanying Action Plan[5] initiated a move towards more integrated, holistic governance in the EU maritime policy landscape. To do so, the IMP mandates better coordination of all sectoral sea-related policies through the deployment of horizontal and cross-cutting planning tools. On this aspect, the programme of work of the IMP clearly identified maritime spatial planning as a fundamental horizontal planning tool for integrated sea use management.

Following the Communication on IMP, the European Commission adopted a Roadmap for Maritime Spatial Planning (European Commission, 2008a) setting out the 10 key principles to support a common approach to MSP among Member States. According to Zervaki (2015) these principles can be classified according to their functions as follows: management principles (objective-setting, monitoring and evaluation), governance principles (stakeholder participation, transparency, institutional arrangements, cross-border cooperation) and horizontal principles (e.g. organisation of data). Under the 2008 Roadmap, Maritime Spatial Planning is defined as a tool to improve decision-making that would function as a framework for arbitrating between competing human activities and managing their impact on the marine environment with an objective: to balance sectoral interests and achieve sustainable use of marine resources.

2.3. EU Maritime Strategy for the Atlantic Ocean Area

The EU Maritime Strategy for the Atlantic Ocean Areas rooted in the IMP. In line with the objectives of the IMP, the Strategy sets the framework for drawing up policies aiming at creating blue growth and sustainable development in the Atlantic Ocean Area. The Strategy targets four challenges for the Atlantic Ocean Area, namely: delivering growth, reducing carbon footprint, promoting sustainable use of the sea's natural resources and the actions to be taken by Member States to address those. The Strategy is supported by the Action Plan for the Atlantic (European Commission, 2013a) and considers the responses to the five challenges identified by the Strategy under four priorities. The EU and Member States are invited to join their research, investment capacity and skills on a wide range of key actions, including MSP cross-border coordination, data sharing, innovation and ecosystems monitoring.

The Strategy for the Atlantic Ocean directly encompasses the Celtic Seas region as it covers the Atlantic macro-region which comprises the regions and islands of the Atlantic coast of Ireland, United Kingdom and France.

2.4. Integrated Coastal Zone Management

Integrated Coastal Management (ICM, European Commission, 2007) has been defined by the EU Commission as a tool for the integrated and coherent management of all human activities and policy-making in the coastal zones, including land-sea interactions of coastal activities with a view to ensuring the sustainable development of coastal areas[6]. As with MSP, ICM is an integrated management tool under the

[5] European Commission (2008) Action plan for an integrated maritime policy. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV%3Al66049

[6] Further information available at: https://ec.europa.eu/maritimeaffairs/policy_en

IMP. ICM aims to join-up all policies which have an effect on coastal zones by ensuring that planning activities and development decisions are taken in an integrated manner, rather than on a sectoral basis.

The main distinction between these two concepts pertains to their geographical scope. Where ICM covers coastal lands and coastal waters, MSP only manages human activities that take place in marine waters excluding coastal waters (waters located landward of the baseline). However, their geographical scopes overlap across the Mean High Water Spring and Low High Water Springs. When applied jointly, MSP and ICM can be used as complementary tools to include land-sea interactions in planning processes as required under Article 7 of MSP Directive. In this respect, ICM has been put forward by the IMP as a means of providing better integration between terrestrial planning systems and MSP. ICM finds a policy basis in Council Recommendation 2002/413/EC (European Council, 2002). The 2002 Recommendation sets out common principles (including coherence of spatial planning across the land-sea boundary) and calls on Member States to develop ICM strategies. In the Celtic Seas, ICM has been operationalised by many local initiatives.

2.5. Marine Strategy Framework Directive

The Marine Strategy Framework (MSFD) Directive (2008/56/EC) is the environmental pillar of the IMP and as mentioned previously, requires Member States to achieve Good Environmental Status (GES) by 2020, to apply an ecosystem approach, and to ensure that pressures from human activities are compatible with GES (MSFD, Article 2). To do so, Member States shall, for each marine region or sub-region, develop and implement a programme of measures to achieve and maintain the GES of marine waters (Article 13(1)). The MSFD does not explicitly refer to MSP but requires Member States to develop national programmes of measures incorporating management measures that influences where and when an activity is allowed to occur (Annex VI (3)). Member States are further required to cooperate where they share a marine region or sub-region and use existing regional structures for coordination proposes, including with third countries (MSFD, Article 5).

2.6. Birds and Habitats Directives

The Birds Directive (2009/147/EC) requires Member States to designate Special Protection Areas (SPAs) for 194 Birds species and other migratory species listed to ensure their survival and reproduction (Article 4, Birds Directive). Likewise, similar spatial areas have to be adopted under the Habitats Directive (92/43/EC) for habitats and species listed with Special Areas of Conservation (SACs) and SPAs being mandatory. The provisions of the Birds and Habitats Directives apply to all maritime areas over which a Member State has jurisdiction and thus, to the extent that the Member State has jurisdiction, to the limit of the Exclusive Economic Zone. SPAs and SACs are therefore enforceable in territorial seas and EEZs of Member States. The Natura 2000 network of protected areas currently covers ~6 % of European seas with further efforts being made to ensure at least 10% of Europe's seas are protected through a coherent MPA network by 2020 (European Commission, 2015). In 2014, 6.65% of all waters of the Celtic Seas region were incorporated into the OSPAR Network of MPAs (OSPAR Commission 2015).

2.7. Strategic Environmental Assessment Directive

The Strategic Environmental Assessment (SEA) Directive (2001/42/EC) influences the plan-making process by requiring a systematic environmental assessment of plans and programmes likely to have significant environmental effects (article 3) and transboundary consultation on these impacts (article 7). The SEA Directive transposes into EU law the provisions of the Espoo Convention since the ratification by

the EU of the Kyiv (SEA) Protocol (United Nations, 2003). The Espoo Convention stipulates that Parties shall ensure that an environmental impact assessment is undertaken prior to a decision to authorise or undertake a proposed activity that is likely to cause a significant adverse transboundary impact (Article 2(1)). It also requires Parties to notify (Article 3) and consult (Article 5) each other on all major projects under consideration that are likely to have a significant adverse environmental impact across borders.

Under the SEA Directive, plans and programmes subject to SEA are those which are prepared/adopted by a public authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government and required by legal, regulatory and, administrative provisions.

The SEA Directive specifically refers to plans and programmes for fisheries, energy, industry, transport and tourism (Article 2 (2)) as well as plans and programmes which have been determined to require assessment pursuant to the Habitats Directive (Article 2(2) b)). Under Article 8 of the MSP Directive, activities and uses that may be included in maritime spatial planning include inter alia: aquaculture areas, fisheries areas, installations and infrastructures for the exploration, exploitation and extraction of oil, gas and other energy resources, maritime transport and tourism. Maritime spatial plans are thereby likely to cover sectors and activities that fall within the scope of the SEA Directive. As such a strategic environmental assessment must be undertaken whenever environmental effects of maritime spatial plans are likely to be significant.

The Directive further requires that transboundary consultations are carried out whenever the plan and programme that is to be developed within national boundaries is likely to have significant cross-border effects on the environment of neighbouring Member States. Before the adoption or submission of the maritime spatial plans to the legislative procedure, Member States shall forward a copy of the draft plan and the relevant environmental report to neighbouring Member States and shall enter into consultation at the request of other Member States concerning the transboundary effects of implementing such maritime spatial plans (SEA Directive, Article 7).

2.8. Common Fisheries Policy

Conservation of marine biological resources under the Common Fisheries Policy (Regulation 1380/2013) is an exclusive competence of the European Union. To achieve the objectives of sustainable exploitation of marine biological resources, the EU is entitled to establish conservation measures governing the access to waters and resources. These measures may include spatial restrictions such as limitations or prohibitions on the use of certain fishing gears and fishing activities in certain areas to protect aggregations of endangered species and vulnerable marine resources (Regulation 1380/2013, Article 7(2)(c)(d)). The CFP also allows the Union to designate, as part of multiannual plans, a network of protected areas that are considered as biologically sensitive. In such areas fishing activities may be restricted or prohibited (article 8(2)). For instance, a long-term recovery plan for cod stocks in currently in place in the Irish Sea and West of Scotland. The recovery plan has triggered the adoption of real-time closure areas for juveniles in the Scottish EEZ, West of Shetland (Scottish Government, 2016).

3. Governance Settings and Status of MSP

This section reviews current governance settings and status of MSP in countries bordering the Celtic Seas which are the United Kingdom, Ireland, France and the Isle of Man. Structures and legal frameworks for maritime spatial planning are in place in these countries. However, differences exist regarding the level of progress in the preparation and implementation of maritime spatial plans. A summary of the status of development of national maritime spatial plans in EU and non-EU nations within the Celtic Seas region is provided in Table 2 below with more detailed information provided in subsequent sections.

Table 2. Status of development of national maritime spatial plans in EU and non-EU nations within the Celtic Seas region.

Country	Status of National MSP as of January 2017
Scotland	• March 2015; National Marine Plan published covering area between Mean High Water Springs to 200 nautical miles. • May 2015; Scottish Marine Regions Order enacted to define 12 marine regions. • Marine Planning Partnerships set up to add local information to the National Marine Plan.
Northern Ireland	• Borders with Ireland, Isle of Man and UK (Scotland and England) at 12nm limit. • Cross-border loughs with IE (Carlingford Lough and Lough Foyle); looked after by the Loughs Agency – some outstanding issues relating to marine borders between NI and IE. • Consultation on draft NI National Marine Plan expected in June 2016. Adoption expected by end of 2017. • Department of Agriculture, Environment and Rural Affairs (DAERA) loses its current function for terrestrial planning but retain responsibility for marine planning, licensing and fisheries after the NI Elections in 2017.
France	• No single planning authority covers all four sea basins in which FR has an interest (Eastern Channel; North Atlantic & Western Channel; Southern Atlantic; Mediterranean) – instead, 4 Planning Authorities but no single one in the lead; new process to understand • Marine Plans are under preparation (deadline 2017): supported by Sea • Basin Strategy documents and being prepared by 4 pairs of Préfects (covering administrative and navigational functions)
Ireland	• Competent authority for MSP is the newly formed Department of Housing, Planning, Community and Local Government • Irish Marine Institute to assist with MSP development but won't adopt or implement it. Most likely format is for a single national plan with regional sub-plans
Wales	• Pre-consultation draft of National Marine Plan to be ready later in 2016. Pressure on limited human resources.

Country	Status of National MSP as of January 2017
England	• Eastern Regions inshore and offshore Marine Plans completed; Southern Region inshore and offshore Marine Plans in preparation (draft reports). Remaining 7 Marine Areas to be prepared *en bloc* by 2021.
Isle of Man	• UK Crown Dependency but not member of EU • Activity toward MSP but no plan as yet

3.1. United Kingdom

Across the United Kingdom, maritime spatial plans are developed under national primary legislation including the Marine and Coastal Access Act (2009), the Marine Scotland Act (2010) and the Northern Ireland Marine Act 2013. The UK Marine Policy Statement (2014) was developed to provide a framework for MSP across the UK. It provides the high level policy context within which national and sub-national maritime plans can be developed, implemented, monitored, amended and seeks to ensure appropriate consistency in maritime spatial planning across UK marine areas.

3.1.1. England

The Secretary of State for Environment, Food and Rural Affairs (DEFRA) is the marine plan authority and has delegated most of the functions in respect of marine plans to the Marine Management Organisation (MMO), an executive non-departmental public body**.** MSP in inshore (up to 12 nautical miles) and offshore waters (12 nautical miles to 200 nautical miles) is regulated by the Marine Policy Statement setting out policy objectives for UK marine waters and the Marine and Coastal Access Act. Eleven marine areas have been designated for this purpose[7] and maritime spatial plans shall be developed by 2021 for each marine region (MMO, 2014a). To date, the MMO has completed the Eastern Region inshore and offshore Marine Plans (MMO 20114b) and a draft plan for the South (MMO, 2014c). Under the Marine and Coastal Access Act 2009, each Marine Plan is subject to a Sustainability Appraisal. Sustainability Appraisals assess the environmental as well as socio-economic impacts of maritime spatial plans developed in the marine regions with the aim to take steps to avoid and/or mitigate these impacts. A scoping report for the SA has now been completed for the north east, north-west, south east and south west marine plans[8]. These scoping reports set the framework and approach for the SA process and explains how it will be undertaken in the marine planning process.

3.1.2. Wales

Under the Marine and Coastal Access Act 2009, Welsh Ministers are responsible for developing Marine Plans for Welsh inshore and offshore waters and a National Marine Plan[9] is currently being developed. To start the planning process, the Welsh Government undertook an eight week consultation process on the draft Statement of Public Participation in 2014[10]. Following this, a 12-week consultation on

[7] Map available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/325688/marine_plan_areas.pdf

[8] Available at: https://www.gov.uk/government/consultations/marine-plan-sustainability-appraisal-scoping-report

[9] Available at: http://gov.wales/docs/drah/publications/151130-welsh-national-marine-plan-initial-draft-november-2015-en.pdf

[10] Sustainable Development for Welsh Seas: Our Approach to Marine Planning in Wales: A Summary of Consultation Responses. Available at: https://consultations.gov.wales/sites/default/files/consultation-documents/121122marineplanningsummresponsesen.pdf

the Draft Vision and Objectives for the Welsh National Marine Plan including the scope for Sustainability Appraisal was launched in August, 2014. The 2015 Wales Coastal Directory and the Welsh Marine Strategic Advisory Group also provide a list of stakeholders and organisations with coastal and marine interests that are likely to be involved in the planning process (see 2015 Wales Coastal Directory map: http://gov.wales/docs/drah/publications/150805-wales-coastal-directory-group-map-en.pdf).

An Initial Draft of the Wales National Marine Plan and a sustainability appraisal were published in November 2015 and a Marine Planning Evidence Portal has been established to support the Welsh Government's work. Formal consultation on the Welsh National Marine Plan is expected to take place in mid-2017 following the publication of the Hendry Review of Tidal Lagoons as this will have significant implications for a number of proposed schemes on the Welsh coast.

3.1.3. Scotland

Maritime spatial planning in Scotland for devolved matters in inshore waters (out to 12 nautical miles) is governed by the Marine (Scotland) Act 2010, an Act of the Scottish Parliament, and for all reserved matters and in its offshore waters (12 to 200 nautical miles) by the MCAA 2009. Scottish Ministers have powers to develop maritime spatial plans and exercise this power through Marine Scotland, a Directorate of the Scottish Government. In 2015, Scottish Ministers adopted Scotland's first National Marine Plan. The National Marine Plan covers inshore and offshore waters, comprising of two Plans in one which are regulated under the two separate pieces of legislation: The Marine Scotland Act (2010) and MCAA 2009.

Under the Marine Scotland Act 2010, Scottish Ministers may adopt regional maritime spatial plans. In accordance with the Marine Regions Order 2015, Regional Marine Plans will be developed and implemented at a local level within twelve Scottish Marine Regions, extending out to 12 nautical miles[11]. Regional marine planning functions will be delegated to Marine Planning Partnerships to take account of local circumstances and smaller ecosystem units. Partnerships will develop Regional Marine Plans for their areas which will set economic, social, marine ecosystem and climate change objectives and state policies for sustainable development. Partnerships will develop statements of public participation, ensuring that local communities and stakeholders have the opportunity to contribute to the plan development. The plans will only become binding after a period of public consultation and adoption by Scottish Ministers. A Pilot Regional Maritime spatial Plan for Pentland Firth and Orkney Waters[12] was published in March 2016. While this is not a statutory marine plan, the Pilot Plan sets out planning policy framework in advance of the statutory Regional Plans for both the Orkney and North Coast Marine Regions.

3.1.4. Northern Ireland

Maritime spatial planning in offshore waters of Northern Ireland is regulated by the Marine and Coastal Access Act 2009. The Marine Act (Northern Ireland) 2013, which builds on the provisions of the 2009 Act, provides for a strategic system of marine planning in Northern Ireland's inshore region (0-12 nautical miles). The Department of Agriculture, Environment and Rural Affairs – Marine and Fisheries Division is the responsible planning authority. DAERA is currently developing marine plans for both the

[11] A map of Scottish Marine Regions is available online : http://www.gov.scot/Topics/marine/seamanagement/regional/Boundaries/SMRmap

[12] Available at: http://www.gov.scot/Publications/2016/03/3696/downloads

inshore and offshore regions. The Draft marine plan was sent to consultants for a Sustainability Appraisal assessment in September 2015. The SA and consultations on the Draft Northern Ireland National Marine Plan are expected to be held in the late 2016, early 2017.

3.2. Ireland

The provisions of the MSP Directive are transposed into Irish law by the European Union (Framework for Maritime Spatial Planning) Regulations 2016. The Regulations establish the necessary legal basis for the Minister to implement Maritime Spatial Planning. The legal framework for maritime spatial planning in Ireland has emerged as a component of Harnessing Our Ocean Wealth – An Integrated Maritime spatial Plan for Ireland (HOOW) (Irish Government, 2012). In accordance with the recommendations of the Enablers Task Force on MSP, created under HOOW, the competent authority is the Department of Housing, Planning, Community and Local Government with the Marine Institute having a role in the technical aspects underpinning the implementation of maritime spatial planning. The Department of Housing, Planning, Community and Local Government is currently working with the Marine Institute to define the technical parameters to be provided by the Marine Institute to prepare a Marine Plan for Ireland's territorial sea and EEZ.

3.2. France

To date, the French National Sea and Seashore Strategy Framework (Stratégie Nationale pour la Mer et le Littoral)[13] is currently being reviewed. The final version is to be adopted at the end of 2016, early 2017. The National Strategy sets the high level objectives for French marine waters up to 200 nautical miles. The Strategy will be specified at the sub-national level by: 1) Marine Basin Strategy Documents (in oversea territories), and 2) Maritime Front Strategy Documents (mainland). These documents specify the goals of the National Strategy and define at local level the management objectives, the spatial organisation of maritime uses and environmental interests. Each Maritime Front Strategy Document will contain a planning section dedicated to the implementation of maritime spatial planning. The Maritime Front Strategy Documents will be developed by 2018 by the pairs of Préfets in charge of the coordination of each French Maritime Front, through the Maritime Front Administrative Commission. Public consultations have already been conducted in order to establish a first assessment of the ecological status and current and future demands of maritime activities and uses in the French part of the North Atlantic-Western English Channel front. The consolidated assessment will be published early in 2017. The initial assessment is to be integrated in the Strategy Document for the North Atlantic-Western Channel Maritime Front.

3.3. Isle of Man

The Isle of Man is a UK Crown Dependency that is not part of the EU. The Isle of Man therefore does not have to implement the provisions of the Maritime Spatial Planning Directive. However, the Isle of Man is a signatory to the OSPAR Convention and to the United Nations Convention on Biological Diversity. To date, there is no maritime spatial plan for the Isle of the Man. However, there have been activities that contribute to the development of maritime spatial planning. In 2012 the Manx Marine Environmental Assessment was published, which compiles technical data on territorial waters. This was intended to form a baseline of evidence on environmental issues to support a future Isle of Man Marine Plan. This is not a policy document but a technical statement on the features of the territorial waters (e.g. physical

[13] The Draft version of the National Strategy for the Sea and Seashore is available online http://www.consultations-publiques.developpement-durable.gouv.fr/IMG/pdf/Projet_de_strategie_nationale_de_la_mer_et_du_littoral.pdf

environment, biodiversity, fisheries, historic environment, infrastructures, tourism, recreation, education).

More recently, the Isle of Man and its territorial sea was designated a UNESCO Biosphere Region in April 2016. It is the first complete jurisdiction to receive this accolade. As part of this designation the Isle of Man is required to produce a Management Plan for the Biosphere, focusing on a zoned approach. The marine area is therefore zoned to reflect current conservation and fisheries management measures.

New primary legislation has also been introduced in the Isle of Man. The Marine Infrastructure Management Act 2016 provides for a streamlined consenting process for certain marine infrastructure developments within the controlled marine area which extends from the Mean High Water Mark to the limits of the Isle of Man's territorial seas. The Act gives the ability for the Isle of Man to prepare Marine Plans and policy statements. Work is currently progressing on the drafting of the necessary secondary legislation which will underpin the Act.

4. OSPAR Region III: The Celtic Seas

The marine region under consideration by the SIMCelt project corresponds broadly with OSPAR Region III: Celtic Seas and sits within the larger North Eastern Atlantic. This region encompasses coastal and offshore waters of the Continental Shelf between 48° N and 60° N and from 5° W of the island of Britain to 9° W of the northwest coast of France. The area includes waters inshore of the 200m depth contour at the shelf edge off western Ireland and from Ile de Sein off the western coast of Brittany seaward to the Celtic Sea shelf break (Fig. 2). Extending beyond these limits, the SIMCelt region of interest also includes an additional area of French maritime jurisdiction superjacent to the Celtic Seas Shelf and extending eastwards to include the southern portion of the Gulf of St. Malo in the Western English Channel (~2° W). This additional area corresponds geographically with a proposed extension of OSPAR Region III recently submitted by French authorities, the eastward boundary of which coincides with French limits of the Northern-Atlantic sea-basin and Western-Channel (NAMO). Inclusion of this latter maritime area allows for futher involvement of the Inter–Regional Sea Directorate (DIRM) NAMO, the French authority responsible for implementation of the MSP Directive in this area. The entire SIMCelt region therefore includes all or parts of the Exclusive Economic Zones (EEZs) of three EU Member States (Ireland, UK and France) and crosses territorial boundaries between the devolved administrations of Scotland, Northern Ireland, England and Wales. Additional boundaries occur with the Crown dependencies of Jersey, Guernsey and the Isle of Man.

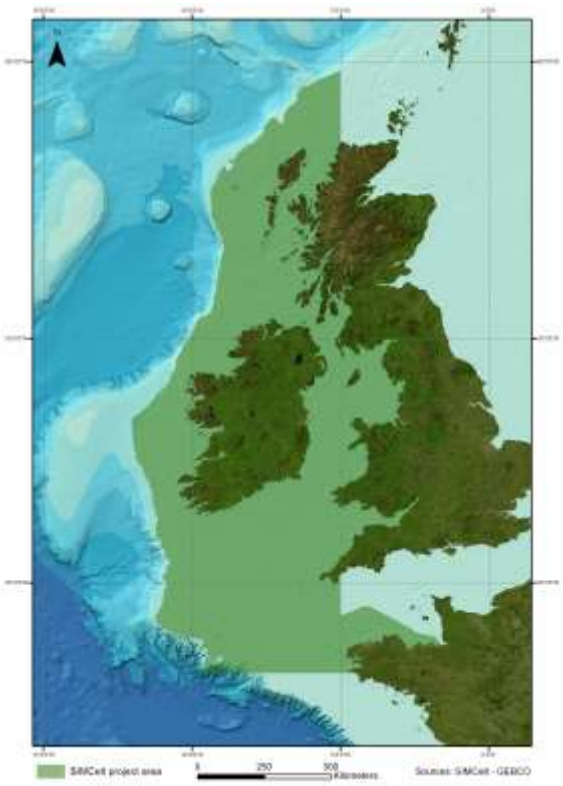

Figure 2. SIMCelt study area comprising current extent of OSPAR Region III and proposed extension westward from Gulf of St. Malo.

4.1. The Marine and Coastal Environment

The following sections provide an overview of these primary hydrographic features, further description of key habitats and associated commercially important species, habitats and species of conservation concern and an assessment of the emerging human pressures that threaten the achievement of GES in the Celtic Seas region.

4.1.1 Bathymetry and Hydrography

The SIMCelt region of interest lies over the North Eastern Atlantic Continental shelf where a characteristically steep slope separates relatively shallow shelf waters (250 m) from the deep ocean (2 000 m). The general pattern of water circulation is northward and dominated by a deep (500 m – 780 m) poleward flowing Shelf Edge Current (SEC) that transports water of Iberian origin northward as far as the Norwegian Sea (Fig. 3) (White and Bowyer, 1997). The SEC is strongest to the north of the Porcupine Bank but south of this dissipates completely and is replaced by a pattern of seasonal stratified flows and retentive gyre circulation during summer. This is characterised by a continuous cyclonic circulation pathway that

extends or 700 km along coastal margins from the Iroise Sea in the southern Celtic Seas along the southern and west coasts of Ireland as far as Malin Shelf off south-western Scotland (Fernand et al. 2006). Formed in association with bottom fronts found at the margins of cold water domes that become trapped underneath a strong thermocline at the onset of summer stratification, this consists of a series of fast moving (0.2 m^{s-1}) narrow (10-20 km wide) baroclinic jets that support significant northward advection of warm water species to the south and west coasts of Ireland (Raine et al. 2010).

Around the Irish coast, the cyclonic circulation pathway becomes the Irish Coastal Current (ICC) and extends northward along the west coast of Ireland and onto the Malin Shelf (~56° N) off western Scotland (Fig. 3). The ICC is flanked to the west by the Mid-Shelf Front (MSF) which occurs as a contiguous surface to bottom front separating, year-round, coastal and oceanic water of different salinities at the continental shelf break. The MSF represents one of several biologically significant shelf fronts found across the Celtic Seas and Western Irish Sea where turbulence caused by the front entrains nutrients from deeper water to the surface encouraging high primary productivity and associated aggregation of commercially important fish species (Savidge, 1976). Others include the Ushant Front (UF) in the Iroise Sea, the Celtic Seas Front (CSF) at the southern entrance to the Irish Sea, the Irish Sea Front (ISF) and the Islay Front (IF) between Islay and the north eastern coast of Northern Ireland (see Fig. 3 opposite). The Islay Front persists throughout winter while others form seasonally at the confluence of tidally mixed inshore and thermally stratified offshore waters during summer.

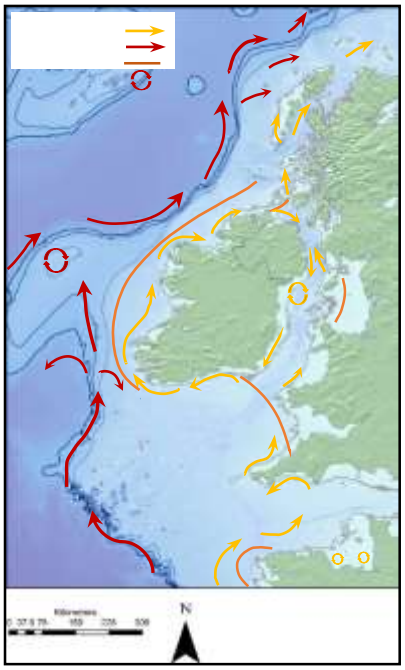

Figure 3. Bathymetry and key hydrographic features within the SIMCelt Celtic Seas region of interest.

Travelling northward the ICC undergoes significant mixing with waters of Atlantic origin weakening as it enters the southern Malin Shelf (Innall et al. 2009). Continuing eastward the ICC travels across the Islay Front and into the North Channel propagating southward as a residual nearshore flow through the Western Irish Sea. The Islay Front extends ~65 km along a permanent pycnocline between Malin Head and the Southwest tip of the isle of Mull and separates deep, high salinity ($37^{o/00}$) Atlantic water from fresher surface coastal waters ($35^{o/00}$) (Simpson et al., 1979). Inshore the low salinity waters of the Scottish Coastal Current (SCC) comprise a mixture of Irish Sea and Clyde Sea water flowing northward from the North Channel and undergoing slight further dilution by inputs of fresh water from the fjordic sea-lochs along the Scottish west coast (Hill et al. 1997a). The SCC continues north westward through Tiree passage and into the Sea of the Hebrides where it bifurcates westward toward the southern coast of Barra and northward through the Minch – the channel running between the inner and outer Hebridean islands. In the northern Minch, divergent components of the SCC continue northward and undergo significant mixing and exchange with the SEC before entering the North Sea (Burrows and Thorpe, 1999).

The Irish Sea is a shallow (20 – 100 m), semi-enclosed sea basin characterised by a seasonal patchwork of tidally mixed and thermally stratified regions. Net long-term circulation is weakly northward although local currents can move in the opposite direction at points close to the coast (Raine, 2014). Tidal energy inputs in the southern Irish Sea tend to be large but dissipate northward within a deep channel (~130 m) running parallel to the coasts of Ireland and the Isle of Man. Exceptionally weak tidal currents (0.3 $m.s^{-1}$) here combine annually with strong seasonal stratification to form a cyclonic, near-surface gyre (Hill

et al. 1997b) similar to that occurring over Porcupine Bank during summer. This so-called Western Irish Sea gyre acts as an important retention mechanism for the planktonic larvae of the commercially valuable Norway Lobster, *Nephrops norvegicus* (Hill et al. 1996) and also for pelagic juvenile fish (Dickey-Collas et al. 1997). West of the gyre an inshore coastal current carries water northwards to the North Channel where mixing with water from the outer Clyde results in seasonal formation of the ISF (Simpson and Hunter 1974). The ISF is apparent as a marked horizontal gradient in sea surface temperature (~1°C km^{-1}) separating stratified waters in the north-west from tidally mixed waters in the south-east of the Irish Sea.

Net shelf flow across the Celtic Sea proper is eastwards with relatively weak tidal circulation over the central shelf and locally pronounced areas of stratification during summer. Consequently the CSF develops seasonally at the boundary between thermally stratified shelf water and tidally mixed waters of the southern Irish Sea and Bristol Channel. In contrast to the Celtic Sea shelf, tidal currents immediately east of the CSF are strong with tidal ranges in the the Bristol Channel among the largest in the world, reaching up to 14 m. Similarly, strong tidal currents towards the mouth of the English Channel combine with irregular bathymetry and seasonally strong winds to create an eastward flowing “river” of well-mixed water through the Channel. This is bounded on either side by a series of nested gyres that play a locally significant role in the retention and dispersal of suspended material (nutrients, larvae, pollutants, etc.) within embayments off both the Southern English and Breton coasts (Ménesguen and Gohin 2006; Nicolle et al. 2013). Moreover, such features not only influence surface circulation but the structure of the entire water column, water quality at depth and the structure and composition of the underlying benthic habitat (Uncles 1983).

The Iroise Sea marks the southern limits of the SIMCelt region of interest and stretches from the islands of Ile de Sein to Ushant off the coast of the Finistere region in Western Brittany. This is a shallow (mean depth 110m), seasonally stratified coastal system lying at the northern boundary of the hydrographically dynamic Bay of Biscay. The area is dominated in summer months by the Ushant thermal front which separates warm surface waters of the Celtic and Armorican shelves from an area of cool, tidally-mixed water closer to shore (Le Boyer et al. 2009). Turbulent exchange at the front makes it a predictable location for the occurrence of large, long-lived blooms of diatoms with associated enhanced levels of secondary production from May to about October (Landeria et al. 2014). Consequently, the Iroise Seas is exceptionally rich in marine life and is a designated UNESCO biosphere reserve since 1988[14] and France's first marine park since October 2007[15].

4.1.2 Ecosystem Overview

The hydrodynamics of the Celtic Seas exert a strong influence on the diversity of ecosystems found in the region with a mosaic of coastal and shelf, benthic and pelagic habitat types and their associated species assemblages found. For example, the spatial distribution of suspended material including sediments, nutrients, larvae, Harmful Algal Blooms (HABs), pollutants etc. is strongly influenced by tidal and non-tidal circulation and retention patterns in turn, affecting ecosystem productivity, species abundance and the distribution of ecologically sensitive and commercially important species (Dickey-Collas et al. 1997; Hill et al. 1996, 1997b; Ménesguen and Gohin 2006; Raine 2014). Table 3 below provides a summary of the status of biodiversity within the region and more detailed information on the ecology of key coastal, pelagic and benthic habitats is provided in subsequent sections. This also includes a consideration of

[14] For further information see: http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=FRA+05

[15] For further information see: http://www.parc-marin-iroise.com/

relevant anthropogenic pressures linked to human activities such as fishing and shipping and having an impact on biodiversity status.

Table 3. Biodiversity status in the Celtic Seas (ICES 2015)

Receptor		Description
Pelagic habitats		Water quality generally good; certain inshore areas eutrophied; hazardous substances levels high in Irish Sea. Significant changes in phenology, population structure and productivity of plankton communities with consequences for other trophic levels.
Benthic habitats		ICES Celtic Sea ecoregion Primarily sublittoral sedimentary with areas of rock and hard substratum in northern and inshore areas. Number of habitats/species classified as threatened and/or declining (OSPAR); Status of marine habitats under Habitats Directive predominantly unfavourable in UK, Ireland and France (2013).
Fish		High diversity with several commercially important benthic and pelagic species. Among these OSPAR listed threatened species incl. spurdog, common skate, angel shark, porbeagle and some deep-water sharks. Almost one third of assessed stocks in GES, one quarter were not (EEA, 2015)
Marine mammals and turtles		Where known, status is generally good. Reported increase in grey seal population over past thirty years, now stabilising (ICES 2015).
Birds		Large number of areas in Celtic Sea region important breeding sites for at least 23 species of seabirds and waterfowl. However, seabirds showing declining trend i.e. since 2003 there has been an increase of >35% in no. species whose abundances have fallen below target levels since 2003. Causes not yet fully understood but thought to be mainly due to climate change and fishing activities (EEA, 2015)
Key		Good status
		Some concerns
		Poor status

4.1.3 Coastal and Benthic Habitat

The coastline of the Celtic Seas houses a diversity of both high and low energy coastal habitats including small island archipelagos, rocky shores and headlands, cliff formations, salt marshes, estuaries and intertidal mud and sand flats. These are home to a rich diversity of fish and fauna, including many commercially important and ecologically sensitive species (OSPAR Commission 2000; Beauchard et al. 2014). Many of these species have relatively short migration routes between feeding and spawning areas with distinct stocks of the same species recognised within the region. Estuaries in particular, represent an important coastal feature of the Celtic Seas region influencing both offshore and inshore environments. The most important estuaries are the Severn Estuary and Morecambe Bay in the English coast; Carmarthen Estuary in the Welsh coast; Solway Firth in the Scottish coast; and Dundalk Bay and Shannon Estuary in the Irish coast. Within Northern Ireland, estuaries are poorly developed and major sea loughs have negligible freshwater influence.

Subtidal areas are similarly diverse and, depending on local hydrographic conditions, range from of sublittoral rock to soft sediment types (Fig. 4). For example, the English Channel, most of the Celtic Seas, and low energy environments of the Irish Sea are characterized by fine muds, sandy muds, sand and gravel. In contrast, high energy areas such as the North Channel, south-west and west of Isle of Man and the Bristol Channel are characterised by bedrock outcrops and platforms. Closer to the shelf break the seabed is dominated by sands and gravels with the notable occurrence of an inshore cold-water coral reef, the Mingulay Reef Complex (red areas in Fig. 4 below), in shallow water off the west coast of the Outer Hebrides (Douarin et al. 2014).

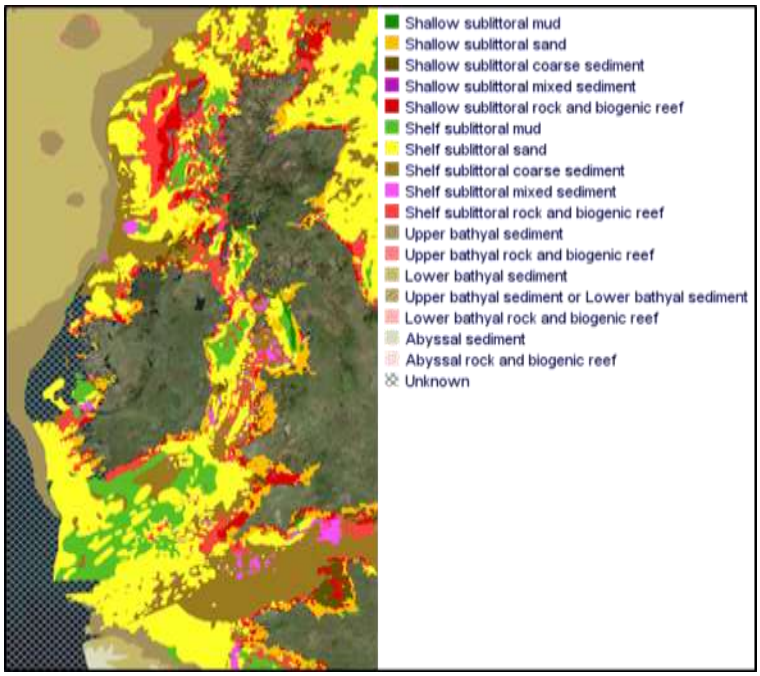

Figure 4. Broad-scale predictive seabed habitat map for Europe – EMODNet MSFD predominant habitat classification.

Within the Bristol Channel other biogenic reef forming species such as the Ross worm (*Sabellaria spinulosa*), blue mussel (*Mytilus edulis*) and maerl (*Phymatoliton calcareum, Lithothamnion corallioides*) are common[16]. Through the North Channel along the west and north coasts of Scotland extensive rock habitats occur in most inshore areas and further offshore. Sponge and turf communities as well as kelp and seaweed communities dominate here. Additional large areas of mixed sediments and coarse to muddy sands are also present in this region.

Many of the larger faunal species associated with these coastal and seabed habitats are commercially important, for example scallops, Norway lobster, crabs, lobsters and bivalve shellfish. Smaller benthic species serve primarily as a source of food not only for commercially-important flatfish such as plaice and sole but also for a wide range of other predatory fish, birds and marine mammals (OSPAR, 2000). The Celtic Seas also support a high proportion of the North-East Atlantic sea-pen and burrowing megafauna communities within sheltered areas such as Scottish sea lochs or withine deeper parts of the shelf (OSPAR, 2010). Surveys show that the distribution of macrofaunal communities in the Irish and Celtic Seas reflect the nature of the benthic sediments, water depth and latitude. This is important as it means that for a particular sediment type and depth a certain mix of species ought to be present and major deviations from the expected composition might be an indication of external influence from human activities (OSPAR 2000)

The major commercial invertebrate species in the Celtic Seas ecoregion is Norway lobster (*Nephrops norvegicus*). It is targeted by trawl fisheries on the continental shelf west of Scotland, on the Rockall plateau, and both south and west of Ireland. Common cuttlefish, *Sepia officinalis*, is also exploited in the Celtic Seas. Major fisheries dredging for scallops and some smaller bivalves exist in the western Channel, Irish Sea, and

[16] For further information see: http://www.devotes-project.eu/wp-content/uploads/2014/02/Annex-3_D1.4_Ecosystem-Overview-of-the-European-Regional-Seas.pdf

west of Scotland. Pot fisheries exploit lobster, *Homarus gamarus,* and brown crab, *Cancer pagurus,* in the waters around the Channel Islands (French landing about 150 t year 1), and west of Scotland. In addition to major aquaculture activity for oysters and mussels, some beds of wild oysters and buried bivalves such as cockles, *Cerastoderma edule,* are exploited by professional and recreational fisheries (for example in Morecombe Bay).

4.1.4 Pelagic Habitat

The Celtic Seas Region is classified as a Class II moderately productive ecosystem (150-300 $gCm^{-2}{\cdot}yr^{-1}$) (ICES, 2016) with increases in phytoplankton biomass reported for the northern part of the Celtic Seas Shelf since the late 1990s (Aquarone et al. 2008; Nolan et al. 2009). The seasonal cycle of phytoplankton growth and biomass accumulation is highly dependent on water column structure and typically proceeds with a diatom dominated spring bloom in well-mixed, high nutrient content waters (Barton et al. 2015; O'Brien et al. 2012). The timing of the diatom spring bloom exhibits large spatiotemporal variations usually occurring one month later in the Irish Sea compared to the more open shelf waters to the north and south (Sharples 2007). With increasing thermal stratification, diatom dominance is replaced by dinoflagellate and microflagellate dominance and attendant lower rates of productivity during summer (O'Brien et al. 2012). Harmful algal blooms are also a common occurrence around Irish coasts, with the highest occurrence noted along the south-west of Ireland during mid and late summer (ICES 2008; Raine et al. 2008). In the more open waters of the Malin Shelf and Celtic Seas, summer dinoflagellate dominance is often followed by a second smaller diatom bloom in autumn before the winter sets in. As with the spring bloom, the decline of the autumn bloom occurs about two months earlier on the Malin Shelf and Celtic Seas Shelf compared to the Irish Sea (ICES, 2016; O'Brien 2012).

Within the zooplankton community, the herbivorous copepods of the genus *Calanus* predominated in northern parts of the Celtic Seas waters play a key ecosystems role in the North Eastern Atlantic. In the Celtic Seas, they are the most abundant form of zooplankton and may account for over 97% dry weight of the total zooplankton biomass. Smaller species predominate in the tidally-mixed near-shore environments, and to a lesser extent, the stratified regions of the Irish Sea. Larger species are more suitable as prey for fish larvae and are abundant in the Celtic Seas and Malin Shelf (OSPAR, 2000). As with phytoplankton, there are strong inter-annual variations in zooplankton abundance throughout the Celtic Seas with implications for the availability of food supplied for fish larvae (ICES, 2016). Important biogeographic shifts in zooplankton community structure however have been reported across large parts of the North Atlantic where, due to increasing ocean warming, the previously dominant sub-arctic species, *C. finmarchicus*, is progressively being replaced by the warm-temperate species *C. helgolandicus* (Beaugrand 2003; Gregory et al. 2009).

4.1.5 Habitats/Species of Special Concern

The Celtic Seas is home to several key protected habitats including (among others) tidal rapids, *Zostera* beds. submerged or partially-submerged sea caves, *Sabellaria* reefs, coastal saltmarsh, maerl beds, cold water corals, saline lagoons, mudflats, sheltered muddy gravel, mud habitats in deep water, sublittoral sands and gravels, estuaries, littoral and sublittoral chalk (ABPmer, 2016a). Threatened and/or declining habitats[17] include biogenic reefs of horse mussels, *Modiolus modiolus*, maerl, and Serpulid worms (full list

[17] Further information available at: http://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats

found in Table 4 below). These occur in specific locations within the Irish Sea and along the west coast of Scotland and support benthos of conservation interest such as sea fans and structurally-complex bryozoans.

Figure 5. Designated Natura 2000 sites (red) and L. pertusa distributions (green) in and around the Celtic Seas region. Data source: EMODNet

To protect this rich biodiversity, 482 sites are currently designated protected marine nature conservation zones with 53 proposed sites within the region. The Iroise Sea off western Brittany for example, is particularly rich in seaweeds and macroalgae and is listed as an OSPAR Marine Protected Area with a large part of its perimeter also protected within the Natura 2000 network (Fig. 5). The Natura 2000 network of protected areas currently covers ~6 % of Europe's maritime area (European Commission, 2015) with just over 11 million hectares, or 12% of the total are of the Celtic Seas region designated as a conservation site (ABPMer 2016). In addition, a further 6.1 million hectares within the Celtic Seas may be designated in the near-term, increasing the total area designated for conservation to 19%. Further reading on the status of marine protected areas in the Celtic Seas can be found in the European Environment Agency Report (2015) and a complete list of threatened and/or declining species from the Celtic Seas region is provided in Table 5 overleaf.

The occurrence, along the shelf slope west of Ireland and Scotland, of spatially contiguous and ecologically significant deep-water reefs of the cold-water coral, *L. pertusa* (Davies et al. 2008), is notable (Fig. 6). These reefs play an integral role in sustaining deep-water ecosystem diversity (Campbell et al. 2010) providing vital habitat for commercially important fish stocks (Foley et al. 2009) and included within both the Natura 2000 and OSPAR networks of MPAs. Furthermore, although these reefs occur beyond the immediate action area of the SIMCelt project, their sensitivity to anthropogenic impacts (Rogers 1999; Mormede and Davies 2001) and protected status under the EU Habitats Directive they are an important consideration for the MSP process and provide a regionally important example of the requirement for plans to consider the potential "far-field" impacts of intensified maritime activity on sensitive and ecologically significant habitat (Underwood et al. 2013).

Table 4. OSPAR List of threatened and/or declining habitats in the Celtic Seas region

DESCRIPTION	OSPAR Regions[18] where the habitat occurs	OSPAR Regions where such habitats are under threat and/or in decline
HABITATS		
Coral Gardens	I, II, III, IV, V	All where they occur
Deep-sea sponge aggregations	I, III, IV, V	All where they occur
Intertidal *Mytilus edulis* beds on mixed and sandy sediments	II, III	All where they occur
Intertidal mudflats	I, II, III, IV	All where they occur
Lophelia pertusa reefs	All	All where they occur
Maerl beds	All	III
Modiolus modiolus beds	All	All where they occur
Ostrea edulis beds	II, III, IV	All where they occur
Sabellaria spinulosa reefs	All	II, III
Sea-pen and burrowing megafauna communities	I, II, III, IV	II, III
Zostera beds	I, II, III, IV	All where they occur

[18]The OSPAR Regions are:

I - **the Arctic**: the OSPAR maritime area north of latitude 62°N, but also including Iceland and the Færoes;

II - **the Greater North Sea**: The North Sea, the English Channel, the Skagerrak and the Kattegat to the limits of the OSPAR maritime area, bounded on the north by latitude 62°N, on the west by longitude 5°W and the east coast of Great Britain, and on the south by latitude 48°N;

III - **the Celtic Seas**: the area bounded by, on the east, longitude 5°W and the west coast of Great Britain and on the west by the 200 metre isobath (depth contour) to the west of 6°W along the west coasts of Scotland and Ireland;

IV - **the Bay of Biscay/Golfe de Gascogne and Iberian coasts**: the area south of latitude 48°N, east of 11°W and north of latitude 36°N (the southern boundary of the OSPAR maritime area);

V - **the Wider Atlantic**: the remainder of the OSPAR maritime area

Table 5. OSPAR List of threatened and/or declining species in the Celtic Seas region

SCIENTIFIC NAME	Common name		OSPAR Regions where the species occurs	OSPAR Regions where the species is under threat and/or in decline
	English	French		
INVERTEBRATES				
Nucella lapillus	Dog whelk	*Pourpre petite pierre*	All	II, III, IV
BIRDS				
Puffinus mauretanicus	Balearic shearwater	*Puffin des Baléares*	II, III, IV, V	All where it occurs
Sterna dougallii	Roseate tern	Sterne de dougall	II, III, IV, V	All where it occurs
FISH				
Alosa	Allis shad	*Alose vraie ou Grande Alose*	II, III, IV	All where it occurs
FISH				
Anguilla anguilla	European eel	*Anguille européenne*	I, II, III, IV	All where it occurs
Centroscymnus coelolepis	Portuguese dogfish	*Pailona commun*	All	All where it occurs
Centrophorus squamosus	Leafscale gulper shark	*Petit squale*	All	All where it occurs
Cetorhinus maximus	Basking shark	*Requin pèlerin*	All	All where it occurs
Dipturus batis (synonym: *Raja batis*)	Common Skate	*Pocheteau gris*	All	All where it occurs
Raja montagui (synonym: Dipturus montagui)	Spotted Ray	*Raie douce*	II, III, IV, V	All where it occurs
Gadus morhua	Cod	*Cabillaud (morue)*	All	II, III
Hippocampus guttulatus (synonym: *H. ramulosus*)	Long-snouted seahorse	*Cheval de mer(hippocampe) à long bec*	II, III, IV, V	All where it occurs
Hippocampus hippocampus	Short-snouted seahorse	*Cheval de mer (hippocampe) à museau court*	II, III, IV, V	All where it occurs
Lamna nasus	Porbeagle	Requin taupe	All	All where it occurs
Petromyzon marinus	Sea lamprey	*Lamproie marine*	I, II, III, IV	All where it occurs
Raja clavata	Thornback skate / ray	*Raie bouclée*	I, II, III, IV, V	II
Rostroraja alba	White skate	*Raie à bec pointu*	II, III, IV	All where it occurs
Salmo salar	Salmon	*Saumon de l'Atlantique*	I, II, III, IV	All where it occurs
Squalus acanthias	[Northeast Atlantic] spurdog	*Aiguillat commun*	All	All where it occurs
Squatina squatina	Angel shark	*Ange de mer*	II, III, IV	All where it occurs

SCIENTIFIC NAME	Common name		OSPAR Regions where the species occurs	OSPAR Regions where the species is under threat and/or in decline
	English	French		
MAMMALS				
Balaenoptera musculus	Blue whale	*Baleine bleue*	All	All where it occurs
Eubalaena glacialis	Northern right whale	*Baleine franche noire*	All	All where it occurs
Phocoena phocoena	Harbour porpoise	*Marsouin commun*	All	II, III

4.2. Emerging Pressures in the Celtic Seas

Recent independent scientific assessment of the Celtic Seas ecosystem undertaken by the International Council for the Exploration of the Sea (ICES, 2016) reveals five key pressures acting on Celtic Seas ecosystems. These include i) the selective extraction of species, ii) abrasion, iii) smothering, iv) substrate loss, and v) nutrient and organic enrichment and are linked, to a greater or lesser degree, to the following human activities: fishing, aquaculture, coastal construction, land-based industry, maritime transport, agriculture, dredging, and offshore structures for renewable and non-renewable energy sources. Figure 6 below - developed from earlier pressure assessments (ICES 2015a, b) and taken from the incipient overview report of the ICES Celtic Seas working group - provides a snapshot of these activity-pressure linkages where the width of lines indicates the relative importance of individual links. The following sections describe these links in greater detail

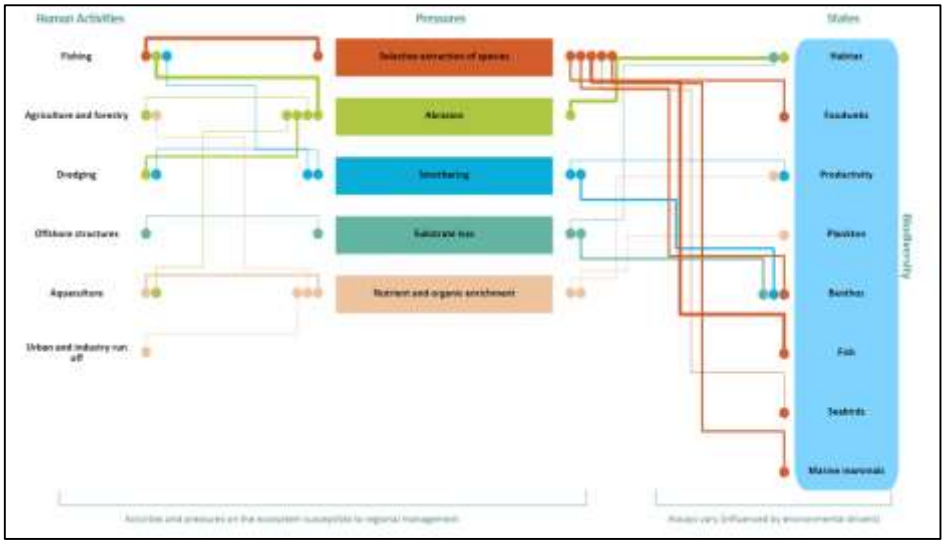

Figure 6. The ICES glossary of principle ecosystem pressures in the Celtic Seas ecoregion[47].

4.2.1. Selective extraction of species

As with other ICES ecoregions, by far the major contributing factor to selective extraction in the Celtic Seas region is fisheries. This has impacted significantly on commercial fish stocks, marine mammal and seabird abundances, threatened and declining fish species resulting in an overall reduction in fishing efforts by most gears. Maximum sustainable yield (MSY) reference points shows that of 26 stocks evaluated by ICES, 15 stocks are now fished at or below MSY (Fig. 7). Furthermore, several fish species such as spurdog

Squallus acanthias, the common skate complex Dipturus spp., angel shark Squatina squatina, porbeagle Lamna nasus, and some deep-water sharks subject to unsustainable fishing pressure in the past are now included on the OSPAR list of threatened and declining species. The Celtic Seas ecoregion overview also reports threats from longline fisheries, pelagic trawls and bottom setnets to population abundances of great shearwaters, *Puffinus gravis,* common dolphin, *Delphis Delphinus,* and harbour porpoises, *Phocoena phocoena*, respectively. However, reduced fishing activity and the increased use of acoustic alarms are thought to have mitigated these impacts in recent years.

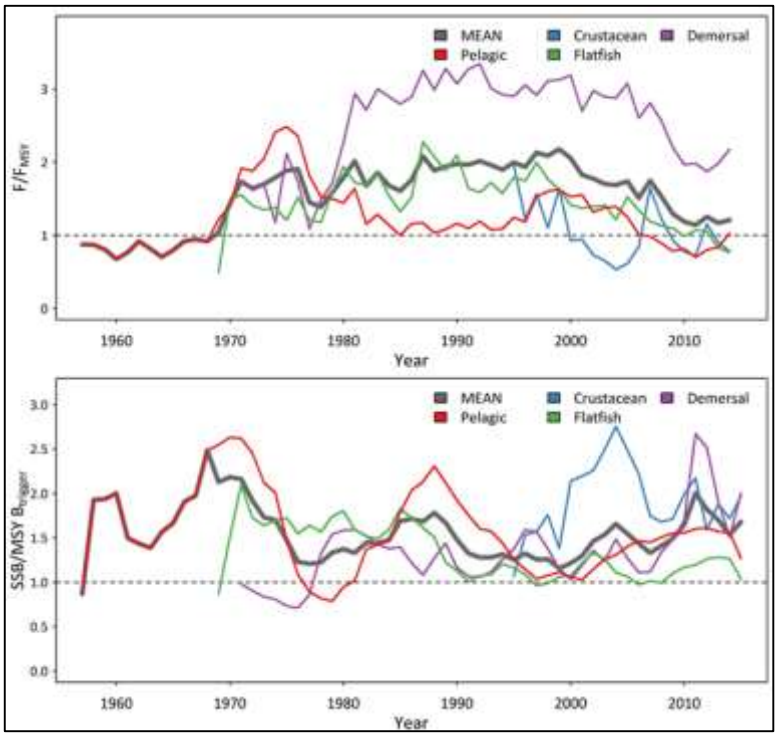

Figure 7. Time-series of relative fishing mortality (F to FMSY ratio) and biomass(SSB to BMSY trigger ratio) by fish guild. Mean F and mean SSB is by total number of stocks with reference points. (ICES,2016)

4.2.2. Nutrient and organic enrichment

In the Celtic Seas, eutrophication resulting in reduced dissolved oxygen concentrations caused by excessive nitrogen or phosphorous inputs, is restricted to estuaries, harbours, and especially areas of high population density and/or intensive agricultural activity. In particular, eutrophication is concentrated in the Bristol Channel, Irish Sea, estuaries including the Mersey estuary, Liverpool Bay, Belfast Lough, Cork Harbour and Dublin Bay (EEA,2001) and along the south coast of Ireland and west coast of Brittany (see Fig. 8 overleaf). The primary causes of eutrophication in the Celtic Seas are agriculture, atmospheric deposition, urban waste water, industry, and aquaculture. The major sources of nitrogen and phosphorous input in the environment are diffuse losses (i.e. agriculture and atmospheric deposition) and sewage treatment works in particular from urbanized coastal areas.

4.2.3. Smothering

Human activities such as dredging for shipping, disposal of materials to the seafloor, and commercial fishing, Maerl and aggregate extraction have contributed to smothering in the Celtic Seas. Similarly,

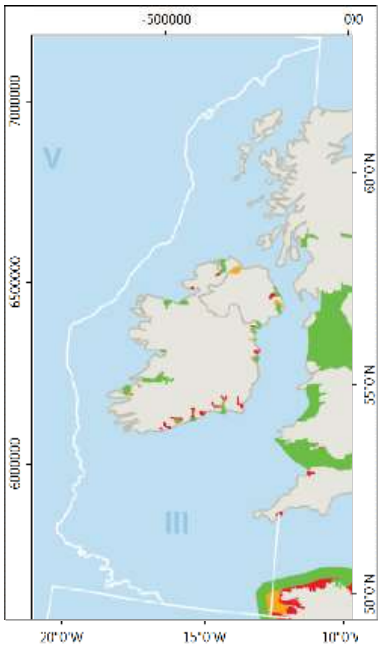

Figure 8. Eutrophication status in the Celtic Seas, 2001 – 2005. Red = problem area; Yellow = potential problem area; Green = non-problem area. Data source: OSPAR 2010.

sediment accretion (land mass increases caused by water-borne sediment deposition) and sediment release issues associated with growth of new species such as cordgrass *Spartina spp* has been reported in coastal wetlands of Cork Harbour for example (Early et al.,2009). Cordgrass is recorded as an invasive species in Ireland and colonises sheltered mud flats at tidal levels below the normal salt marsh vegetation. The resultant dense monoswards slow the movement of water and increase the rate of silt deposition, raising the general level of the marsh and preventing the establishment of other species populations and thus potentially reducing biodiversity.

4.2.4. Abrasion

ICES estimates that mobile bottom trawls used by commercial fisheries in the 12 m+ vessel category have been deployed over approximately 235 000 km^2 of the Celtic Seas in 2013, corresponding to ~. 26% of the ecoregion's spatial extent (excl. Spanish fishing effort). Fishing is mainly concentrated along the shelf edge, i.e. around the southern shelf regions and on fishing grounds in the Irish Sea and to the west of Scotland. The proportion of swept seafloor has gradually reduced by ca 2.5% from 2009 until 2013 (fig. 9).

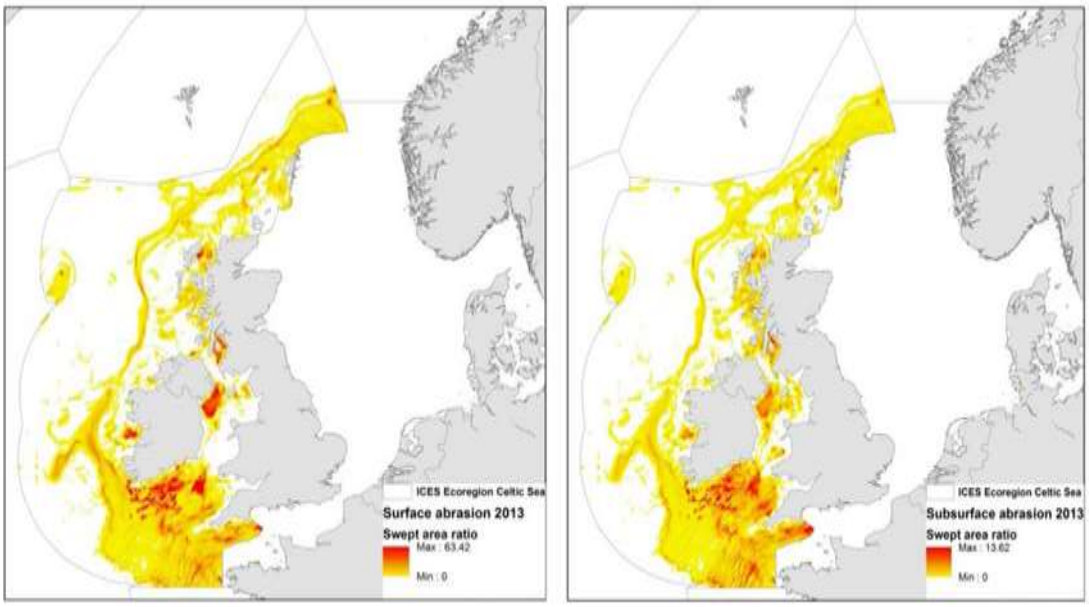

Figure 9. Surface and subsurface abrasion pressure expressed by swept area ratio from VMS data from 2013 (ICES, 2015b).

4.2.5. Substrate Loss

This includes permanent loss of coastal habitats and the permanent change of one marine habitat to another. Substrate loss pressure is in Celtic Seas is based on activities such as land claim, new coastal defences and the installation of infrastructures such as hydrocarbon production facilities, wind farm foundations, marinas, pipelines, cables, and scour protection. According to OSPAR, 13000 individual structures have been placed in the OSPAR area whiles 145 hectares had been from the sea and coastal wetlands. The locations of land reclamation and coastal defence structures in the Celtic Seas are shown in Figure 10.

Figure 10. Location of land reclamation and coastal defence structures Source: OSPAR.

4.2.6. Other pressures

According to OSPAR, 2016 other pressures of potential concern in the Celtic Seas ecoregion are the introduction of contaminating compounds, the introduction of non-indigenous species, litter, and underwater sound. Contaminants are localized and restricted to coastal areas, with levels of most contaminants declining. However, reported levels of polychlorinated biphenyls (PCBs) in both killer whales, *Orcinus orca,* and bottlenose dolphins, *Tursiops truncates,* have the potential to inhibit reproduction (Jepson et al. 2016).

5 Maritime Activities

The EU's blue economy currently provides 5.4 million jobs and contributed a gross added value of just under €500 billion per year in 2012[19]. This encompasses a variety of stakeholders with varying needs and interests. In the Celtic Seas region, key maritime activities include shipping, tourism and leisure, oil and gas, fisheries, aquaculture, marine aggregates, telecommunications and bioprospecting. These industries provide nearly 354,000 jobs (Table 6) with the shipping and tourism/leisure sectors accounting for over 80% of these.

Table 6. Total maritime employment (all sectors incl. fisheries) for France, UK and Ireland. Source: ECOTEC Research & Consulting, 2006.

Country	Total maritime employment (sectors and fisheries)
UK	613, 864
France	486, 853
Ireland	18, 100

Increased use of the marine environment is leading to increased pressure on ecosystems and biodiversity. Under the Blue Growth strategy maritime jobs are expected to increase to approximately 7 million jobs and €600 billion per year by 2020. Given the three dimensional nature of the marine environment and potential for overlap of different sea uses, it is vital that MSP takes into account both fixed structures (offshore windfarms, aquaculture etc.) as well as temporary and mobile activities (e.g. navigation and fishing etc.). This section of the report will discuss maritime activities and the stakeholder landscape involving: maritime transport, shipbuilding, fisheries and aquaculture, maritime and coastal tourism, oil and gas exploration, underground coal gasification and subsea cables in the Celtic Seas region.

5.1. Maritime transport and Ports

5.1.1. Overview

The Celtic Seas host 32 ports with the major ports being located in Liverpool, Milford Haven, Dublin, Glasgow, Belfast, Bristol and Brest (Fig. 11 overleaf; EU, 2014a). In 2014, approximately 212 million tonnes of freight were transported through the ports of the Celtic Seas with approximately 87 million passengers travelling on either domestic ferries, short sea routes or international routes.

The most recent figures are provided in the Port Annual Reports. These figures show an overall increase in shipping traffic through the Celtic Seas. For example, in Cork Harbour (IE), traffic amounted to 11.02 million tonnes in 2015 compared to 10.15 million tonnes in 2014 representing an increase of 871,713 tonnes or 8.6%. This increase is mostly represented by container freight (8% increase in 2015, 13% in 2014), oil traffic (21%) and trade car imports (48%) (Port of Cork Company, 2015). In the southern part of the Celtic Seas, the number of vessels in transit in the Ushant Traffic Separation Scheme (TSS) for 2015 amounted to 42,858 vessels (117 vessels per day) (Cross Corsen, 2015). The Ushant TSS came into force in May 2003

[19] Further information available at: http://ec.europa.eu/maritimeaffairs/policy/blue_growth_en

following several shipping incidents in this high risk, headland area most notably, the Amoco Cadiz oil spill of 1978 (Fairhall and Jordon, 1980).

Apart from the Ushant TSS, the Celtic Seas also include the first segment of the English Channel - one of the busiest shipping routes in the world. For example, in the segment of the English Channel located the Celtic Seas region, the Marine Management Organisation estimates the average density of ships in transit is estimated at 7 108 vessels for a 42-days period (169 per day) (MMO, 2014). This report is based on AIS information collected in 2012 and AIS maps from a shipping Density Grid provided by the MMO can also be used to identify the main shipping tracks through the Celtic Seas (MMO, 2014e).

Figure 11. Ports and harbours in the Celtic Seas. Modified and reproduced with permission from ABPmer & ICF Int.. 2016

Additional figures for the Irish Sea region confirm an increasing trend in shipping density for the Celtic Seas region generally. In 2015 for example, shipping cargo volumes handled through Dublin Port facilities grew for the third consecutive year, reaching a record of 32.8m tonnes handled in 2015 (+6.4% from 2014) (Dublin Port Company, 2015). The most recent data show that trade volumes in Dublin Port rose by 8% for the first six months of 2016, with 3782 ships arrivals in Port facilities. Similarly Milford Haven, the second fastest growing port in the UK, handled 37.8 million tonnes of cargo in 2015, an overall increase 10.1% compared to 2014 (Port of Milford Haven, 2015). In terms of shipping traffic, 6000 cargo carrying vessels passed through Liverpool Port, 4000 in Milford Haven and Cairnryan in 2015 (Department of Transport, 2015).

The types and average number of vessels fitted with an Automatic Identification System (AIS) i.e. all ships weighing ≥ 300 GT, and that transit the Celtic Seas are shown in Table 7 below. The figures show traffic densities for all vessels [20]. Vessels such as commercial vessels weighing less than 300 GT, recreational vessels, fishing vessels less than 15 m in length and Military/Government vessels are not legally obliged to carry AIS. Therefore, the full magnitude of shipping through flow in the Celtic Seas cannot be accurately represented. For example, there are currently 140 coastal marinas in the Celtic Seas with a total of 27,000 berths for unmonitored recreational boats (Ecorys, 2014).

[20] Real-time AIS maritime traffic density can be viewed online at: http://www.marinetraffic.com/en/ais/home/centerx:-4/centery:50/zoom:7

Table 7. Vessel transits in Celtic Seas region by vessel type (%) (Source: ABPmer, 2016)

Vessel type	Scottish Waters	Irish Sea	West of Ireland and south-west England	South-west Channel
Cargo Vessels	12	23	22	43
Dredging or Underwater Operations	3	3	2	1
Fishing Vessels	21	24	35	23
High Speed Craft	1	6	0	0
Military or Law Enforcement	1	2	1	2
Non Port Service Craft	2	2	0	0
Passenger Vessels	38	9	5	3
Port Service Craft	5	6	12	2
Recreational Vessels	5	4	3	4
Tankers	4	6	9	16
Unknown	8	15	10	6
Total	**100**	**100**	**100**	**100**

5.1.2. Future trends

The EU Document on *Strategic goals and recommendations for the EU's maritime transport policy until 2018* addresses important issues and actions in relation to maritime transport, safety, and port reception facilities (European Commission, 2009). It is also a priority under the Maritime Strategy for the Atlantic Ocean Area and the associated Action Plan to upgrade the intermodality of ports, increase port networks and the density of short-sea shipping routes (European Commission, 2013a). Under this framework, a number of legislative and regulatory initiatives have been adopted to improve the sector competitiveness and the attractiveness of maritime transport against other modes of transport. In particular, the Directive on reporting formalities for ships (Directive 2010/65/EU) and the Blue Belt initiative (European Commission, 2013b) aim at facilitating greater efficiency in the shipping sector by streamlining procedures in ports and avoiding unnecessary controls and expenses both for intra EU shipping and ships calling in "third country" ports.

It is difficult to establish specific predictions for the Celtic Seas region, however, a 50% increase in the amount of cargo handled in EU ports is predicted by 2030 (European Commission, 2013c). Ports of the Celtic Seas also foresee a positive trajectory for growth in the coming years. The Master Plan of Dublin Port Company for example, includes infrastructure development to meet the objective of handling 60 million tonnes by 2040 (Dublin Port Company, 2015). This value is based on a putative growth rate of 2.5% per annum. Similarly, the Port of Milford Haven foresees a steady and positive evolution of shipping tonnage in coming decades (Port of Milford Haven 2015).

5.2. Fisheries and Aquaculture

Fishing is an important and intense part of the maritime history of countries around the Celtic Seas with a general pattern of small-scale fishing observed in the south and deep-sea fishing in the north. Blue whiting makes up nearly half of all catches. Other important species are mackerel, jacks and herring. Deep-

sea trawling dominates in the north, from the ports of Ullapool (Scotland) and Killybegs (Ireland), and small-scale fishing is more frequent in the south. According to the EU, in 2014 aquaculture showed strong growth and in particular, salmon farming in Scotland and Ireland, mussel farming in Munster (Ireland), Brittany and Normandy (France) and oyster farming in Brittany and Normandy. The following discussion focuses on commercial fisheries and aquaculture in the Celtic Seas highlighting key drivers and forecasted trends for both sectors.

5.2.1. Overview

Commercial Fisheries

ICES landing records shows that about 1.1 million tonnes of fish and shellfish are landed each year from the Celtic Seas (annual average, 2009-2013). According to ABPmer (2016) the UK lands the largest proportion (29%), Ireland (17%), France (11%), Isle of Man (1%). In 2013, there were quotas for 23 fish species in the Celtic Seas area (ICES subdivisions 6 and 7) including anglerfish, blue whiting, blue ling, boarfish, cod, Greenland halibut, haddock, hake, herring, horse mackerel, ling, mackerel, megrims, Norway lobster (Nephrops), plaice, pollock, roundnose grenadier, saithe, skates and rays, sole, sprat, tusk and whiting (STECF, 2015).

According to STECF (2015) revenue for the EU North-East Atlantic Fleet in 2013 was €2.35 billion, which was primarily shared between France, Spain, UK, Portugal and Ireland. Gross Value Added (GVA) in the same year was estimated at €898 million, of which €314 million was gross profit. Pressures associated with commercial fishing for example, may include: Physical damage to the sea bed, removal of target and non-target species and litter. Again similar to aquaculture these pressures may increase due to drivers such as: market demand, global population growth, technological developments etc..

Aquaculture

While aquaculture production (shellfish and finfish) has grown significantly on a global scale (increase from 5 million to 63 million tonnes over the last 30 years) (Fig. 12, a), growth in Europe over the last decade has remained static at between 1.25 and 1.26 million tonnes per year (Ertör and Ortega-Cerdà, 2015; STECF 2014). Details of main aquaculture production sites in the Celtic Seas region are shown in page 41 of the Future Trends Baseline Report (ABPmer, 2016). The predominant marine species cultivated in the Celtic Seas include finfish, largely pen-based Atlantic Salmon farming, and shellfish including cultivation of molluscs and crustaceans in coastal/marine based aquaculture installations (i.e. on trestles, ropes, bouchot poles or in nets) or cultivated on the seabed (e.g. shellfisheries in Several Orders and private shellfisheries that are set up and improved for commercial exploitation).

Pressures associated with aquaculture include: Physical damage to the sea bed, pollution/chemical changes to the water

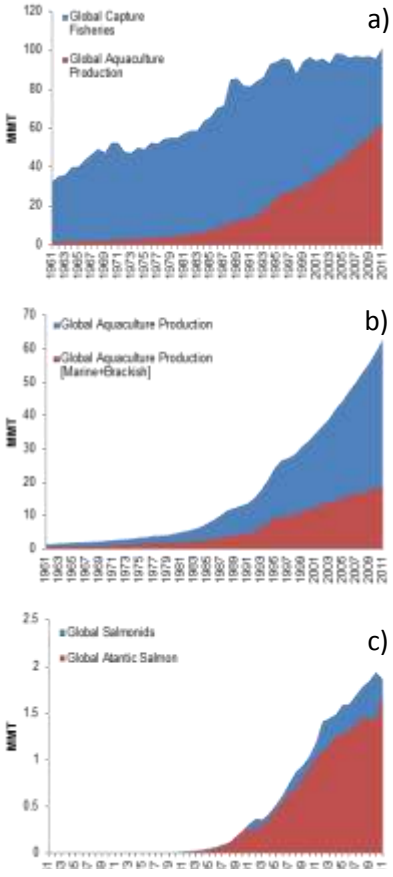

Figure 11. Historic trends in a] global capture fisheries and aquaculture production b] marine and brackish water aquaculture production (as a proportion total annual production) and c] the proportion of annual salmonid aquaculture production (Atlantic salmon).

column, litter, localised changes to the wave regime, biological pressures. These pressures are expected to increase in the coming years due to driving factors such as: EU Blue Growth Strategy, food security, market demand (especially from Asian markets) and global population growth (STECF 2015).

5.2.2. Future trends In fisheries and aquaculture

As the world's population continues to grow at a rapid pace, fish consumption and production is also expected to increase (Douvere and Ehler, 2009; Ertör and Ortega-Cerdà, 2015; FAO, 2012). Total fish supply is projected to increase from a global total of 142,285 Mt in 2008 to 186,842 Mt in 2030 (World Bank, 2013). In Europe, total production from capture fisheries and aquaculture is expected to increase from more than 12 Mt in 1998 to nearly 13 Mt in 2030 (Failler, 2007). Countries that will benefit the most from the total production are the ones in which aquaculture will go up. The UK is expected to make a significant contribution to the growth, with salmon production for example. Diadromous species and molluscs are the two main groups of species that will underlie the growth of the total production until 2030. The projections also show an increase in the demand for seafood products up to 2030. The average per capita consumption will move form 22 kg/c/yr in 1998 to 24 kg/c/yr (Failler, 2007).

Future drivers for fisheries development in the Celtic Seas will be based on policy developments under the Common Fisheries Policy (CFP; Regulation 1380/2013), in particular the requirement to bring exploitation down to levels consistent with achieving maximum sustainable yield (MSY)[21] and the Landings Obligation[22] which is being phased in for demersal stocks over the next few years. Reforms to the CFP and the EMFF however have introduced a framework to change this trend (Regulation 1380/2013; Ertör and Ortega-Cerdà, 2015) with a marked increase in aquaculture production and concurrent decline in fishing vessel fleet size observed across the EU. The Atlantic Action Plan states further actions to promote the potential of aquaculture in the Atlantic (European Commission, 2013a).

5.3. Offshore Renewable Energy

5.3.1. Overview

France, Ireland and the United Kingdom are held by legally binding targets for the share of energy from renewable energy sources in their final gross energy consumption by 2020 Directive 2009/28/EC (Renewable Energy Directive). As part of their obligations, the United Kingdom and France have committed to achieve 18 GW (UK) and 6000 MW (France) of offshore wind capacity by 2020. Offshore wind is currently the predominant technology deployed in the Celtic Seas.

The majority of offshore wind developments in the Celtic Seas region are concentrated in the Irish Sea (Table 9); with ten operating farms in the Irish Sea and an overall installed capacity of over 2 GW. Table 10 below highlights the current (2016), fully commissioned offshore wind capacity with numerous new developments which have been granted licenses now in pre-construction phase e.g. Arklow Bank Phase 2 (Republic of Ireland)[23] or in the early stages of construction e.g. Burbow Bank Extension United Kingdom[24] (UK). Furthermore, in the French part of the Celtic Seas region, an offshore wind farm of 100 turbines is

[21] Further information available at: https://ec.europa.eu/fisheries/cfp/fishing_rules_en

[22] Further information available at: https://ec.europa.eu/fisheries/cfp/fishing_rules/discards_en

[23] Further information available at: http://www.thewindpower.net/windfarm_en_1741_arklow-bank.php

[24] Further information available at: http://www.burbobankextension.co.uk/en

planned for installation in the Bay of Saint Brieuc[25]. The site was selected by the Government in 2013 and will generate 500 MW. The farm will be fully commissioned by 2020.

Table 8. Offshore wind farms located in the Celtic Seas and thier capacity (created using 4C Offshore's Global Offshore Wind Farm Map and Database)

Country	Name of Offshore Wind Farm	MW
UK	Walney	183.6
	West of Duddon Sands	389
	Barrow	90
	Ormonde	150
	Robin Ring	174
	Gwynt y mor	576
	North Hoyle	60
	Burbo Bank	90
	Rhyl Flats	90
Republic of Ireland	Arklow Bank (Phase 1)	25.2
France	N/A	N/A
Total Power (Celtic Seas Region, 2016)		**1.8 GW**

Apart from offshore wind energy, energy from the conversion of tidal and wave resources is also being developed but at a pre-commercial stage. Ireland is currently operating two offshore test sites in Galway Bay and off the coast of Belmullet, Co. Mayo[26]. It is anticipated that a maximum power of 100 MW will be generated from Belmullet test site. In Northern Ireland, the 1.2 MW Seagen tidal energy convertor was installed in 2008 in Strangford Lough[27]. The turbine had generated over 9 GWh as of March 2014. In addition, commercial projects are being developed off Torr Head and Fair Head each planning to deliver 100 MW by 2020.

An important number of wave and tidal energy sites are located in the UK part of the Celtic Seas region. Tables 10 provides an indicative list of current wave and tidal energy projects in the Celtic Seas region. Projects referred to as 'early planning' are projects for which developers have not submitted application for a development consent yet. The link below allows a visualisation of the location of all tidal and wave energy sites present in the United Kingdom part of the Celtic Seas and Northern Ireland. Link to interactive map: https://maps.esp.tl/maps/pages/map.jsp?geoMapId=19671&TENANT_ID=115744

[25] Further information available at: http://www.eolienoffshoresaintbrieuc.com/fr/accueil.aspx

[26] Further information available at: http://www.seai.ie/Renewables/Ocean-Energy/Ocean-Energy-Test-Sites-in-Ireland/

[27] Further information available at : http://www.seageneration.co.uk/

Table 9. Current and projected tidal and wave energy projects in the Celtic Seas (source, UKMarine Energy Database: http://www.renewableuk.com/page/UKMED2; 4C Offshore)

Country	Offshore wave and tidal energy projects	Status	MW
UK	Strangford Lough Tidal Power (NI)	Commissioned	1.2
	Ramsay Sound (Wales)	Commissioned	0.4
	Meygen Tidal Phase 1 (Pentland Firth)	Construction/ installation	86
	Nova Bluemull Sound 5 Tidal turbines (Shetland)	Construction/ installation	0.5
	WaveNet Array (Mingary, Scotland)	Construction/ installation	0.045
	Morlais Tidal Energy Site (North Wales)	Construction/ Installation	120
	Blue Water Energy Service EMEC (Orkney)	Approved	1
	North Lewis Wave Array	Approved	40
	Argyll Tidal Demonstrator Project	Approved	0.5
	Sound of Islay Tidal Array (West Scotland)	Approved	10
	Swansea Bay Tidal Lagoon (South Wales)	Approved	320
	Hollyhead Deep (North Wales)	Approved	10
	DP Marine- West Islay Tidal Energy Park	Application submitted	30
	Marwick Head Wave Farm (Orkney)	Pre-application	60 (phase 1 & 2)
	St David Head (Wales)	Pre-application	10
	West Orkney South Wave Energy	Pre-application	100
	Cardiff Bay tidal lagoon (Wales)	Early planning	1800 -2800
	Torr Head Tidal Farm (NI)	Early planning	100
	Churchill Tidal Barrier (Orkney)	Early planning	23.4
	Lashy Sound (Orkney)	Early Planning	10 (phase 1) + 20 (phase 2)
	Fair Head tidal (NI)	Early planning	100
	North Wales Tidal Energy Lagoon	Early planning	N/A
	Meygen Tidal Phase 2 (Pentland Firth)	Early planning	312
Republic of Ireland	Sea Power Wave Energy converter device (Galway Bay)	Approved	N/A

Country	Offshore wave and tidal energy projects	Status	MW
France	Paimpol Brehat Tidal Farm Phase 2 (Brittany)	Commissioned	1
	Sabella D10 (Ushant Strait)	Commissioned	1
Republic of Ireland	Sea Power Wave Energy converter device (Galway Bay)	Approved	N/A
France	Paimpol Brehat Tidal Farm Phase 2 (Brittany)	Commissioned	1
	Sabella D10 (Ushant Strait)	Commissioned	1

5.3.2. Future trends

Offshore renewable energy is an emerging sector with significant potential to deliver Blue Growth objectives (European Commission, 2012). The growth of the offshore renewable energy sector in the Celtic Seas is expected to increase under the impetus of the European Union. As mentioned before, the European Union has committed to achieve an internal target of 20% of energy from renewable energy sources by 2020 (Directive 2009/28/EU2). Ireland has a 16 % target[28]. France has a 23 % target of energy from renewable energy sources[29] while the United Kingdom is to ensure that 15% of its energy is met from renewable energy sources by 2020[30].

The European Union has established clear objectives underpinning its energy policy by 2050. The EU Roadmap 2050 establishes the EU goals to cut greenhouse gas emission by 80-95% below 1990 level by 2050 (European Commission, 2011c). The Commission's Communication *An Energy Policy for Europe* (European Commission, 2007b) highlighted that an important proportion to the 2050 goals is to be met by renewable energy resources from oceans and seas. In particular, the potential exploitable from offshore wind by 2020 is expected to be 30-40 times the current installed capacity, and in the 2030-time horizon it could be up to 150 GW. The EU also estimates that ocean energy (wave and tidal, ocean thermal conversion and salinity gradient) could satisfy 15% of European electricity demand and, in some countries, up to 20% of national demand by 2050 (European Commission, 2014b). The Ocean Energy Draft Strategy Roadmap (Ocean Energy Europe, 2015) has been published and foresees a cumulative capacity of 850 MW of ocean energy from wave, tidal, salinity gradient and ocean thermal conversion by 2020.

At the level of Celtic Seas countries, the United-Kingdom foresees the deployment of 100 to 200 MW of devices by the end of 2020, with the majority of the sites being located in the Celtic Seas region (Scottish waters, south west of England and Northern Ireland) (Renewable UK, 2013). The Department of Energy and Climate Change estimates that a capacity of 30-50 MW of wave and tidal stream energy (Renewable UK, 2013). In the French part of the Celtic Seas (Brittany), Le Pacte Electrique Breton[31] and Le Schema Regional Climat Air Energie[32] predict an overall capacity of 1000 MW of installed offshore wind capacity by 2020 (floating and fixed bottom offshore wind).

[28] Further information available at : http://www.seai.ie/Energy-Data-Portal/Frequently-Asked-Questions/Energy_Targets_FAQ/

[29] Further information available at: https://www.iea.org/policiesandmeasures/pams/france/name-39508-en.php

[30] Further information available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf

[31] Further information available at: http://www.plan-eco-energie-bretagne.fr/upload/docs/application/pdf/2010-12/pacte_electrique_breton.pdf

[32] Further information available at: http://www.pays-de-la-loire.developpement-durable.gouv.fr/IMG/pdf/140418_SRCAE_PdL.pdf

5.4. Ship Building

5.4.1. Overview

Within the global market, the European shipbuilding industry has a current share of 6% (tonnage) and 35% for equipment (European Commission, 2016)[33]. Within the EU, shipbuilding provides 0.8 million direct and indirect jobs and the industry itself has a turnover of €90 billion (European Commission, 2008. The biggest shipyards in the Celtic Seas are located in Brest, France (Sobrena Shipyards), Falmouth, England (A&P Group Falmouth Shipyard) and Belfast, Northern Ireland (Harland and Wolff). While the number of new vessels to be built however is in decline, maritime transport is expected to increase over the coming years with an attendant increase in associated ancillary activities anticipated. For example, increased activity in related navigation and clean technology sectors including Information Control Technology (ICT) and new technology associated with 'greening the sector' in line with stricter regulations on emissions, noise pollution etc. is expected (ECORYS, 2009).

5.4.2. Future trends

The EU shipbuilding industry used its "LeaderSHIP 2015" initiative developed in 2003 to address some of the competition challenges it faces and to ensure greater global competitiveness of the sector going forward (LeaderSHIP 2015).

The new LeaderSHIP 2020[34] strategy presented by Vice President of the European Commission responsible for enterprise and industry, is expected to spur further growth in the industry through four main areas: research, development and innovation, employment and skills, improving market access and fair market conditions and access to finance. The new strategy provides a series of recommendations for the short and medium term, to support sustainable growth, high value jobs and address the societal challenges that the shipbuilding industry.

The EU Atlantic Action Plan (European Commission, 2013a) also aims to enhance growth in the Shipbuilding industry as it seeks to improve skills in shipbuilding through national and cross border educational and training measures, as well as raising awareness for maritime careers among young people.

5.5. Maritime and Coastal Tourism

Tourism takes a number of forms in the coastal areas of the Celtic Seas maritime region. The shores of Ireland, Wales, West Scotland and South-West England are frequented by hikers in large numbers. The islands in the Celtic Seas (Man, Aran, Scilly islands off Brittany, Channel Islands) are also popular for visits. Tourism takes a number of forms in the coastal areas of this maritime region, both on and offshore. Opportunities for marine-based recreation draw tourists to Brittany, the West of Scotland, the South-west of England and across Ireland. Wales completed its Coastal Path in 2012 and other networks of Coastal Paths around the area are frequented by hikers in large numbers.

5.5.1. Overview

For the purpose of this document, maritime tourism is defined as any tourist activities that use the marine environment (e.g. yachting, surfing, sailing, cruising, recreational fishing). Coastal tourism includes

[33] Retrieved from: http://ec.europa.eu/growth/sectors/maritime/shipbuilding/index_en.htm

[34] Further information available at: http://ec.europa.eu/growth/sectors/maritime/shipbuilding/ec-support_en

activities that take place along the coastlines within the study area, adjacent to the marine environment (e.g. coastal walks, and visitor attractions).

Many other activities are required to support recreation and tourism within the marine environment and along the coast, some of which include the provision of accommodation and other ancillary services, construction of supporting infrastructure such as marinas, manufacturing of equipment, upkeep of beach facilities, piers, and harbours. Although there is a lack of consistent spatial data for most of the maritime and coastal activities, these activities are widespread and particularly concentrated around the South West of England, South Wales, North Wales and the North East of England (ABPmer, 2016). Seaside and nautical tourism along both shores of the English Channel is thought to total ~30 million visitors annually (European Commission, 2014a). Furthermore, quantitative spatial data for marine recreation and tourism in Scotland is available from Marine Scotland's Scottish Marine Recreation and Tourism Survey (2015)[35].

The Celtic Seas was the third most visited region in OSPAR with an estimated 15 million tourists visiting in 2007 (OSPAR 2010). At the Celtic Seas level, estimates by ABPmer (2016) show that for the period 2016–2036, coastal tourism and recreation in the Celtic Seas is likely to support between £91 billion (Business As Usual (BAU) scenario) and £104 billion (Local Stewardship (LS) scenario) with the sector projected to provide 138,000–160,000 jobs. Leisure boating activities in the Celtic Seas are estimated to directly support €870 million (£670 million) of GVA and 20,500 FTE jobs. The maritime tourism sector is of huge value to Ireland, the UK and France. For example, in 2011 approximately 86,000 overseas visitors to Ireland engaged in watersports (of which surfing was the most popular) contributing ~€86 million to the Irish economy (Fáilte Ireland, 2011). Estimated expenditure in the sector in Scotland was to £3.7 billion over the 2013/14 period[36] with continued increasing demand for resources, coastal infrastructure, accommodation and services over a large part of the Celtic Seas Region. Table 11 shows supporting infrastructure for marine and coastal tourism in the Celtic Seas Region.

Table 10. Supporting infrastructure for marine and coastal tourism in Celtic Seas Region

Country	Marinas & Berths (Celtic Seas Region)	Beaches	Blue Flag Beaches
Ireland	65	137	86
France	50	65	2
UK	2	695	55
Total	117	897	143

5.5.2. Future trends

With over 0.6% of GDP in the North East Atlantic generated by coastal tourism and shipping and with coastal tourism being of one the two largest employers in the North-East Atlantic area, growth in the sector is expected (EEA, 2013). The Atlantic Action Plan seeks to preserve and promote the Atlantic's cultural heritage and inform growth in this sector through diversification of maritime and coastal tourism products

[35] Full report available at: http://www.gov.scot/Resource/0049/00497904.pdf

[36] Full report available at: http://www.gov.scot/Resource/0049/00497904.pdf

and development of niche markets.

Projected scenarios and trends by ABPmer (2016) shows that the present value(GVA) over the period 2016–2036 from the tourism and recreation sector ranges from £91 billion (Business As Usual) to £104 billion (Local Stewardship) and the sector is projected to provide 138,000–160,000 jobs in the Celtic Seas. Much of this is expected to take place as a result of the EU's Blue Growth Strategy which highlights coastal tourism as a key sector for the generation of jobs and sustainable growth within the overall Europe 2020 strategy. However, the future for marine and coastal tourism in the Celtic Seas and wider EU is largely dependent on the health of national and global economies and faces increasing competition from low-cost destinations all over the world.

5.6. Marine Aggregate Extraction

5.6.1. Overview

Within the Celtic Seas Region, all extraction of aggregates occurs off the North-West and South-West of England, and some smaller scale extraction off the North-West Coast of France (ICES, 2012). Over 20 million tonnes of marine aggregates are extracted from 65 licensed sites in England and Wales each year (marineaggregates.info). The total seabed licensed in 2015 increased to 932 km^2 (The Crown Estate, 2015). The South West Coast accounts for seven production licences (off Burry Port and Pembroke). The South Coast of England has 14 production licences. According to the Crown Estate figures, 3.05 million tonnes of aggregate were dredged in the South Coast Region (The Crown Estate, 2015). Three production licences are held in the North West Region (off the coasts of Southport and Rhyl). Maps showing Marine Aggregate licensed application areas in Irish Sea-UK, South West marine area are available online at: https://www.thecrownestate.co.uk/media/389767/ei-marine-aggregates-capability-and-portfolio.pdf.

In the North Coast of Brittany, four areas have been licensed: Les Duons, Le Minou, La Horaine and Lost Pic. Additional applications are under review in the sites La Cormandiere, Pointe d'Armor and La Croix[37] Exploitation activities in these areas are focused on the extraction of Maerl and shelly sands. There is currently no commercial aggregate extraction in Ireland, Scotland and Northern Ireland. Despite no extraction occurring off the Irish Coast, minerals have been discovered and cited as a good source of sand and gravel rather than continuing to deplete already low supplies from land based quarries (Sutton, 2008).

5.6.2. Future trends

Estimates from the Crown Estate suggest that there are 22.7 years of primary marine aggregate production permitted in the UK. There is potential for demand to increase from 20 million tonnes to 29 million tonnes per year by 2030 (The Crown Estate, 2015). In Ireland, the forecast aggregate demand linked to population change or construction output and GDP indicate a future annual aggregate demand ranging from 100 to 160 million tonnes per year, with total forecast aggregate demand for the period 2001-2021 ranging between 1.6 billion tonnes and 2.4 billion tonnes (EPA, 2006).

[37] See mapped site locations online at:
http://www.google.ie/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjAmcjLlKHQAhUH;

5.7. Oil and Gas Exploration

5.7.1. Overview

There is relatively little oil and gas extraction in the Celtic Seas. In total, there are approximately 16 producing oil and gas sites in the Celtic Seas Region[38]. Most of these sites are located in the Irish Sea and licensed by the UK Oil and Gas Authority.

In Ireland, there are three main gas producing sites off the South coast (Kinsale, Ballycotton, Seven Heads) and one off the Northwest Coast (Corrib) in Mayo. Collectively, three petroleum leases have been granted for Seven Heads (2002), Corrib Petroleum lease (2001) and Kinsale/Ballycotton (1970)[39]. Petroleum leases vest the Leasee with the exclusive right to produce oil and gas from the leased area. A series of Licence Options for the Atlantic Margin have been launched in 2015. There are currently 14 Petroleum Exploration Licences granted in Ireland. Petroleum Exploration Licences recognise that the Licensee has the exclusive right to carry out exploration for petroleum in a specific area. Oil production in Ireland is still in an exploration phase. Four standard exploration licences have been granted in the Celtic Seas Basin (Barryroe, Hook Head, Helvick Oil project, Dunmore oil project), plus one licensing option (Silverback Oil prospect). Six Frontier Exploration Licences and one Licencing Option (Avalon prospect) have been granted for the West Ireland continental shelf (Porcupine Basin and Goban Spur Basin). In 2016, the Irish Department of Communications, Climate Action & Environment launched two new Oil and Gas Licensing rounds focusing on the Porcupine Basin offering 14 new licensing Options on the Irish Continental Shelf[40].

Oil and Gas production in Scotland and England are mainly located in the North Sea, with some small scale production in the Eastern Irish Sea and Shetland. In the Scottish part of the Celtic Seas Oil and Gas production is located off the North Coast of Shetland (Lagan and Tormorre Fields). There are currently 13 producing fields in the Irish Sea. The Saint George Channel, off the coast of Wales, is also opened to licences. There are 17 UK licensed blocks in the Saint George Channel[41].

5.7.2. Future trends

Demand for oil and gas is linked to the economic cycle. New environmental policies such as the Paris Agreement are calling for a reduction in European CO_2 levels, forcing Member States to turn to renewable energy resources such as offshore wind or tidal energy. With the combination of climate change policies and legislation, the MSFD and the projected increase in MPAs, it is likely that oil and gas production will become less attractive due to new constraints.

Overall in the Celtic Seas region, oil and gas production has been decreasing since 2000. Within Ireland, Oil and Gas production has declined by 4.8% between 2007 and 2012, with the sector described as having low future potential (Government of Ireland, 2012). The 2012 Harnessing Our Ocean Wealth also highlights that Oil and Gas production is the only offshore sector to have declined between 2007 and 2012.

[38] Details on all oil operations, type of licences, plus an operations map for oil exploration and drilling in Ireland is available online at: http://www.providenceresources.com/ireland-southern-porcupine-basin-lo-1627

[39] A list of current Petroleum Leases (Oil and Gas) granted in Ireland is available online at: http://www.dccae.gov.ie/natural-resources/SiteCollectionDocuments/Oil-and-Gas-Exploration-and-Production/Acreage%20Report%20at%201%20October%202016.pdf.

[40] A map showing the current locations of Oil and Gas Licences as per category in the Celtic and Irish Sea is available online at: http://www.dccae.gov.ie/natural-resources/SiteCollectionDocuments/Oil-and-Gas-Exploration-and-Production/compressedA0_concesion_map_oct2016.pdf

[41] Oil and Gas Authority, 2016. UK Continental Shelf 29th Round of Offshore Licensing. Available online at: https://www.ogauthority.co.uk/media/2883/29th_round_offer-311016.pdf

Moreover, the existing gas fields in the Eastern Irish Sea will be decommissioned by 2030 (ABPMer, 2016).

Despite the continued decline, the Irish Department of Communications, Climate Action & Environment have launched a second Oil and Gas Licensing round on the Atlantic Margin and on the Porcupine Basin offering fourteen new licensing Options. The United Kingdom has launched a 29th Oil and Gas Licensing Round in 2016 and licensing options are now opened for application in West Scotland marine area[42].

5.8. Underground Coal Gasification (UCG)

Underground coal gasification (UCG) involves pumping oxygen and steam through a small borehole into the coal seam to produce a small and controlled combustion. The UK is currently the only country in the Celtic Seas where UCG projects are being undertaken. Proposed underground coal gasification (UCG) sites cover more than 1,500 km^2 of seabed off north-west England, Wales and east central Scotland. This could give access to 1 billion tons of offshore coal. A precautionary approach is expected to be taken to fully assess the environmental impacts of the mining. Table 12 provides a list of proposed sites in the Celtic Seas for UCG[43]

Table 11. Proposed UK sites for Underground Coal Gasification

Location	Hectares	Developer	License period	Country
Dee Estuary, near Liverpool	6,953	Cluff Natural Resources	January 2018	Wales
Loughor Estuary, South Wales	4,207	Cluff Natural Resources	January 2018	Wales
Solway Firth, off Canonbie, Dumfries and Galloway	2,800	Five Quarter	December 2016	Scotland
Irish Sea, Liverpool Bay, Wirral	8,350	Five Quarter	December 2016	England
Irish Sea, off Maryport, Cumbria	10,003	Cluff Natural Resources	August 2019	England
Irish Sea, off Workington, Cumbria	8,238	Cluff Natural Resources	August 2018	England

5.9. Subsea Cables

5.9.1. Overview

Power Cables

The importance of submarine power cables has been on the increase in recent times due to the advent of offshore renewable energy which requires these cables to transmit power from wind, tidal and wave installations. Inter-connector cables are being laid to move energy freely throughout Europe, thereby

[42] For locations of 29th round licensed blocks and blocks on offer in the Celtic Seas Region follow: https://www.ogauthority.co.uk/media/2883/29th_round_offer-311016.pdf

[43] Further information available online at: https://www.gov.uk/government/organisations/the-coal-authority

ensuring security of supply. Britain currently has three major electricity inter-connectors in the Celtic Seas area. These link Britain to France, Ireland and Northern Ireland. These links, total 3 gigawatts (GW), these are the Anglo/French Inter-connector = 2 GW form South England to France, Moyle Inter-connector = 500 MW from Scotland to Northern Ireland, East-West Inter-connector = 500 MW from North Wales to the Republic of Ireland (ESCA, 2016). There is also the Isle of Man to England Interconnector, a 3 core cable which covers a distance of 104 km and has a capacity of 0.09 MW. There are also a number of power cables that connect the mainland of Scotland to the islands[44].

Telecom Cables

Over 98% of all communications are transported globally via a network of fibre optic submarine cables, and not via satellite. Telecom cables include sub marine telecommunication cables for carrying telephone calls and internet connections. The Celtic Seas has a rich history in telecom cable connection as the first international submarine cable, a copper-based telegraph cable, was laid across the Channel between the United Kingdom and France in 1850. Again the first Trans-Atlantic Telegraph Cable was laid in 1858 between Ireland and Newfoundland. Frontier Economics reported in 2011 that revenues from the UK telecom industry amounted to £39.7 billion. Table 13 lists subsea cables involving countries in the Celtic Seas, the locations of which can be viewed online in an interactive online map found here: http://nwra.ie/dubh/wp-content/uploads/2016/04/Atlantiic-Maritime-Strategy-May-2013.pdf.

Table 12. Fibre optic network by countries in the Celtic Seas, 2016

Country	No. of Cables Built	Length Laid (km)
France	20	188,783
Ireland	12	24,487
UK	16	189,292
Total	48	402,562

5.9.2. Future Projects and Trends

At the European level, expected completion of projects of pan-European significance would lead to about 4,000 km of existing assets being refurbished and 43,000 km of new assets being built by 2030, of which more than one third is subsea. It is estimated that 4,000 km of the new subsea cables will connect offshore wind farms (half with AC and half with DC technology), and about 12,000 km of DC subsea cables will increase the interconnection capacities (ENTSO-E, 2014b)

Power Cables

Electrical power interconnectors planned for the Celtic Seas include the Western HVDC Link project between the National Grid and Scottish Power which includes a subsea marine cable approximately 385km long from Ardneil Bay to Leasowe on the Wirral peninsula.

There is also the “FAB” project (France – Alderney – Britain) which is proposed to build an electrical interconnector nearly 220 km underwater and underground between France and Great Britain via the island

[44] Further information on existing and proposed subsea cables available online at: http://www.escaeu.org/

of Alderney. The Celtic Interconnector Project is proposed to link Ireland with the European electricity grid using an undersea cable to France which would be approximately 600 km long, of which the offshore element would comprise approximately 500 km. The potential capacity of the Celtic Interconnector is estimated at approximately 700 megawatts (MW), enough to power approximately 450,000 households. The project is currently at a planning stage and with the agreement from all parties, the interconnector is planned to go live in 2025.

The EU is seeking to build more interconnectors to create a single integrated electricity market and to increase cross border electricity exchange as in the FAB project (UKMMAS, 2010). This is expected to increase the number of subsea cables in the Celtic Seas along with planned interconnectors.

Telecom Cables

According to TeleGeography demand for international bandwidth increased by 39% to 138 TeraBytes Per Second (TBPS) in 2013[45] – over 4 times more than the global demand in 2009 (30 TBPS) and this is expected to increase threefold again by 2018. Future projects in the Celtic Seas include the construction of the 15,868 km Arctic Fibre which is expected to have cable landings in Ireland (Cork) and UK (Highbridge)[46].

[45] Further information available at: https://www.telegeography.com/press/press-releases/2013/04/17/international-bandwidth-demand-is-decentralizing/

[46] Further information available at; http://www.submarinenetworks.com/systems/asia-europe-africa/arctic-fiber/arctic-fibre-acquired-by-quintillion-networks

6. Approaches to implementation of Transboundary MSP: SIMCelt Case Studies and Mechanism

Through the case study approach, SIMCelt will illustrate how the implementation of transboundary MSP is and can be, supported in the Celtic Seas. Therefore, the following case studies will incorporate transboundary themes such as sectoral interactions, cumulative impacts in multi-use environment and transboundary data sharing. Through these case studies some of the key issues identified in this report will be explored to see how practical approaches can be developed to address them.

6.1. SIMCelt Case Studies

6.1.1. Case Study 1: Understanding specific cross border issues and opportunities

This case study examines transnational issues and opportunities in the Celtic Seas and aims to understand how a coherent approach to the management of specific transboundary issues in the Celtic Seas can be applied. With the EU committed to generating 20% of total energy consumed by 2020 from renewable sources, offshore energy developments are expected to increase. The impact of this growth on maritime transport and related sectors (commercial, recreational and fishing activities) in the Celtic Seas will be significant. Such impacts can include increased navigational risks e.g. radar interference; reduced access to shipping lanes and/or fishing grounds, creation of 'choke points', and environmental issues e.g. groundings or collisions resulting in oil spills etc. among others.

As of yet, however, no genuine transboundary analysis of these issues has been undertaken for the Celtic Seas; while a coherent approach to cross-border planning in general, is still lacking for the region. Thus SIMCelt case study 1 will look at two cross-border sites that experience high traffic density and subsequent conflicts, namely the western approaches to the English Channel (England, France and Ireland) and the Eastern Irish Sea (Isle of Man and UK).

The approach that will be employed by the case study includes:

- Assessing data integration challenges and opportunities at a transboundary level (especially for fisheries, offshore renewable energy and maritime traffic) and the protocols for aggregation, dissemination and accessibility of data;
- Developing a network analysis ('network map') of the existing institutional structures (identified sectors) and their remits for ensuring cross border data integration and cooperation;
- Examine mechanisms and policies and develop practitioner focused guidelines on how transboundary sectoral conflicts can be addressed to achieve a coherent MSP approach.

6.1.2. Case Study 2: Assessment of Cumulative Impacts in the Irish Sea

MSP requires the assessment of cumulative effects in both forward planning and project decision making. A recent review of the application of the ecosystem approach to MSP concluded that a better developed analysis of the cumulative impacts of human activities on the marine environment is required (MMO, 2014d). The SIMCelt case study on the assessment of cumulative impacts in the Irish Sea will therefore help to address these gaps. Again, there is a continued need for an agreed common language as there is a lack of clarity on how 'cumulative impacts' are defined with respect to the implementation of the MSP Directive. The terms are widely used by regulators, managers, practitioners and academics engaged

in undertaking and evaluating assessments of environmental 'effects', 'impacts' and/or 'pressures' (Judd et al., 2015) but there is often little or no consistency in the approaches taken to evaluate cumulative impacts.

A risk-based framework for bringing together the different components of a cumulative effects assessment would be used. The Options for Delivering Ecosystem-based Marine Management (ODEMM) approach (Robinson et al., 2014) which has been successfully used to inform a risk assessment framework in the Celtic Seas previously would inform this Case Study to identify the potential cumulative impacts. An ecosystem-based approach will be used to identify the activities (sources) and cumulative pressures which could theoretically impact on the ecological components in the marine environment. The starting premise is that an assessment of the cumulative impacts in the Irish Sea requires spatial and temporal information and an understanding of:

- Species or habitats (ecosystem components);
- Trends in baseline indicators for habitat decline, rare or threatened species etc.
- Activities and associated environmental pressures;
- Sensitivities of ecosystem components to pressures;
- Potential effects / impact deriving from the activities and associated pressures;
- Linkages between pressures and ecosystem components;
- Interactions between pressures (e.g. additive, synergistic, antagonistic, neutral);
- Likelihood of exposure of ecosystem components to pressures; and
- What effects/impacts aspects are considered to be significant (Judd, 2015).

6.1.3. Case Study 3: Planning Across Borders

The SIMCelt case study on planning across borders will investigate MSP in the Solway Firth, which is a unique marine ecosystem on the boundary between three of the Administrations that make up the United Kingdom (Scotland, England and Northern Ireland) and the Isle of Man, a non-EU third party. This single marine ecosystem is, therefore, subject to multiple marine planning policies and legislative instruments.

The north of the Solway Firth is subject to the marine planning provisions made by the Marine (Scotland) Act 2010, which provides for a single National Marine Plan for Scotland with additional Regional Marine Plans covering specific geographic areas. The northern half of the Solway Firth will form the Solway Scottish Marine Region in due course, which extends to the border with Northern Ireland at the western limit of Scottish Territorial Waters and abuts the waters of England and the Isle of Man to the south. The southern half will have a different marine planning regime as it will be subject to the provisions of the English Marine Management Organisation through the Inshore and Offshore Marine Plans that are currently being created for the English North West Marine Plan Area.

Since a single ecosystem does not recognise the differences in political jurisdictions or timescales for the introduction of marine planning, this SIMCelt case study offers an opportunity for three constituent parts of the UK to explore the practical application of cross border cooperation across three MSP jurisdictions of the UK. The approach for the Solway case study will include assessing the implications of different policies and timescales in producing marine plans and developing effective and innovative stakeholder engagement in order to avoid consultation fatigue. The case study will also include an assessment and analysis of the requirements of the different marine planning legislation that affects the area with consideration of marine planning alongside terrestrial Local Development Plans, so that issues such as "land/sea interactions" can be better considered in the longer term."

6.1.4. Case Study 4: Understanding and applying ecosystems services to MSP

At both European and national levels there is a requirement to adopt an ecosystem approach to MSP. The United Nation's Millennium Ecosystem Assessment defined Ecosystems Services as the benefits human beings can obtain from ecosystems (MEA, 2003). The MEA and the Economics of Ecosystems and Biodiversity (TEEB) study determined that ecosystems goods and services are generally grouped into four categories; Provisioning, Regulating, Supporting and Cultural services.

Provisioning Services are products obtained from ecosystems, such as food, water and materials.

Regulating Services are benefits obtained from the regulation of ecosystem processes, such as air quality regulation, climate regulation, water regulation, pest and disease control, pollination etc. These services are often strongly interrelated and are also closely related to other services such as provisioning services.

Supporting Services are those which are necessary for the production of all other ecosystem services such as soil formation, photosynthesis, primary production, nutrient cycling and water cycling.

Cultural Service are generally considered to be non-material benefits people obtain from ecosystems through interaction from their surroundings and can take many different forms, from aesthetic appreciation of the natural environment to artistic inspiration, spiritual enrichment, health and wellbeing.

However, increasing pollution levels in the marine environment, unsustainable fishing, global climate change, acidification, habitat destruction and invasive species are just some of the threats to marine and coastal biodiversity and the associated ecosystem services which they provide (Worm et al., 2006). The Ecosystem Services concept can be applied within MSP to help explore the impact of different management options. It uses a more holistic approach as opposed to past single sector management decision-making. The assessment of ESs helps to bridge the conceptual gap between the natural and social sciences (i.e. between marine ecosystems and human preferences) by linking the state of ecosystems (i.e. their processes and functions) with human well-being and activities, even (or perhaps especially) when formal markets are incapable of doing so (Böhnke-Henrichs et al. 2013). The SIMCelt project offers an opportunity to examine ecosystems services at an ecosystem scale within the Irish Sea.

The Irish Sea is generally considered to be an ecologically meaningful biogeographical region which is bounded by several jurisdictions namely the Republic of Ireland, Northern Ireland, Scotland, England, Wales and within which the Isle of Man is located. The challenge of this case study therefore is to understand the concept, including the economic value of services under different scenarios, in a sufficiently practical way that it can be applied by maritime planners. The case study will build on previous work, such as the EU-funded Valuing Ecosystems Services in the Western Channel (ValMER)[49], the Marine Atlantic Regions Network (MARNET)[50], TPEA and Celtic Seas Partnership projects. The case study will focus on a select ecosystem service from each of the four categories listed.

[49] Further information available online at: http://www.valmer.eu/

[50] Further information available online at: http://marnetproject.eu/

6.2. Mechanisms for Cross Border Stakeholder Engagement in the Celtic Seas

6.2.1. Cross border Stakeholder Engagement and the MSP Challenge Game

Through the use of innovative stakeholder engagement tools such as the MSP Challenge Game, the concept of cross-border marine planning and the awareness of stakeholders involved in MSP will be developed. The Clyde Marine Planning Partnership is expected to produce a statutory Scottish regional marine plan. The MSP Challenge Game[51] will be used in engaging stakeholders to aid the development of this plan.

One of the objectives of developing Regional Marine Plans is to add localised layers of definition and detail to the overarching framework created by the Scottish National Marine Plan. Regional Marine Planning partnerships allows for local stewardship of the marine area and provides a platform for local stakeholders to become engaged in identifying and addressing planning issues. For this to work, there is the need for effective stakeholder engagement. One of the first activities of the Regional Marine Planning Partnership is drafting of its Statement of Public Participation, which sets out how stakeholders and the wider public can be engaged in the development of the Regional Marine Plan.

Stakeholders are also encouraged to use the component parts of the MSP process (understanding of the wider issues, negotiation, impact on others interests whiles pursuing their objectives, etc.) to ensure a balance whiles managing activities within a single ecosystem. As most of the Regional Marine Plans involve at least two Local Authorities with connections to a shared marine area, the MSP Challenge Game is designed to encourage cross border engagement among stakeholders who will have their own objectives for Blue Growth and ecological protection but are expected to work together to account for what happens across their administrative boundaries. Through playing the game in the Clyde Region, lessons can be drawn which would inform the subsequent development of Regional Marine Plans around the Scottish coast.

6.2.2. Experience from the TPEA Stakeholder Engagement Process

Experiences from the Transboundary Planning in the European Atlantic in stakeholder engagement will be built on by the SIMCelt Project. TPEA workshops encouraged participants to explore different aspects of transboundary MSP, and share their experiences, expectations, knowledge and opinions in relation to marine planning and in particular their local areas. They also reflected traditions in stakeholder participation and contained presentations, as well as guided group work and interactive exercises.

The following good practices that were developed as a result of this experience will serve as a guideline for SIMCelt;

1. Understanding the benefits of comprehensive stakeholder involvement

Stakeholders have a pivotal role in transboundary MSP, as they represent the various user and interest groups active in the planning area, from statutory, regulatory and non-statutory perspectives. Stakeholder involvement is critical in order to achieve broad acceptance, ownership and their participation is also a source of knowledge that can significantly improve the quality of the planning process. This is particularly important in transboundary contexts, as stakeholders can contribute awareness of cross-border issues and work together in developing shared visions. Stakeholder involvement necessitates the inclusion of

[51] Further information available at: http://www.mspchallenge.info/

representatives from multiple sectors and levels of governance, and where appropriate, their counterparts from adjacent jurisdictions. Particular attention may be given to gaining fair representation of the interests and jurisdictions concerned.

2. Understand opportunities and constraints for stakeholder involvement

The ability of stakeholders to engage in MSP is influenced by the resources available (human and financial), other consultation demands, prioritisation of marine concerns, and the nature of their organisation. Transboundary meetings may be more demanding in terms of travel and effort. To make best use of stakeholder engagement, practitioners should communicate the scope and purpose of stakeholder involvement at each stage of the transboundary process. Stakeholders in turn should feel their input is valued and see the results of their engagement reflected in the process. The engagement process is also framed by relevant legislation on public participation in the MS concerned, European and international conventions and transboundary cooperation and participation.

6.3. Establishing a Framework for Ecosystem Based Transboundary MSP

The spatial and cross border dimensions of a sub-regional ecosystem such as the Celtic Seas and the dynamic nature of human activities and pressures therein makes the need for transboundary cooperation in maritime planning indispensable.

Transboundary MSP is viewed as a process which allows for greater integration and harmonisation between existing management frameworks to facilitate the implementation of an ecosystem-based approach (Backer, 2011). A framework for the application of an ecosystem based transboundary MSP must therefore be explored for the Celtic Seas. One such approach which focuses on translating EBM principles and policy driver objectives into an operational process is the ODEMM Approach (Fig. 13).

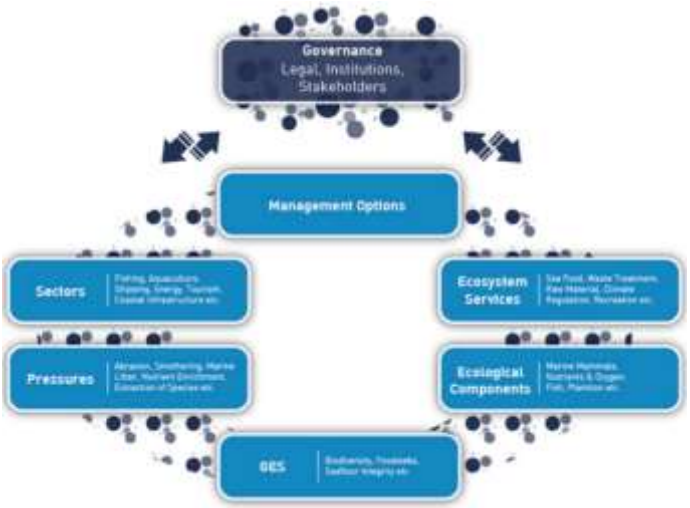

Figure 13. The ODEMM approach

The ODEMM approach consists of a broad governance system constituted by the legal framework, stakeholders and institutions that are used for decision making. In ensuring good environmental status (GES) the approach bases ecological objectives on information and data from ecological components linked to key environmental threats and human-actvity induced pressures and the capacity of the ecosystem to

deliver services. This is termed the ODEMM linkage framework and builds on elements of the DPSIR approach (Drivers, Pressures, State, Impact, Response) (Atkins et al., 2011), which links human uses in the system to pressures and ecosystem state and includes feedback loops, integrating the response to change (Fig. 14). This approach suggests that in appraising environmental management options, a cost benefit analysis based on information and data from marine sectors, ecosystem service analysis, state of ecological components, pressures from marine sectors is undertaken.

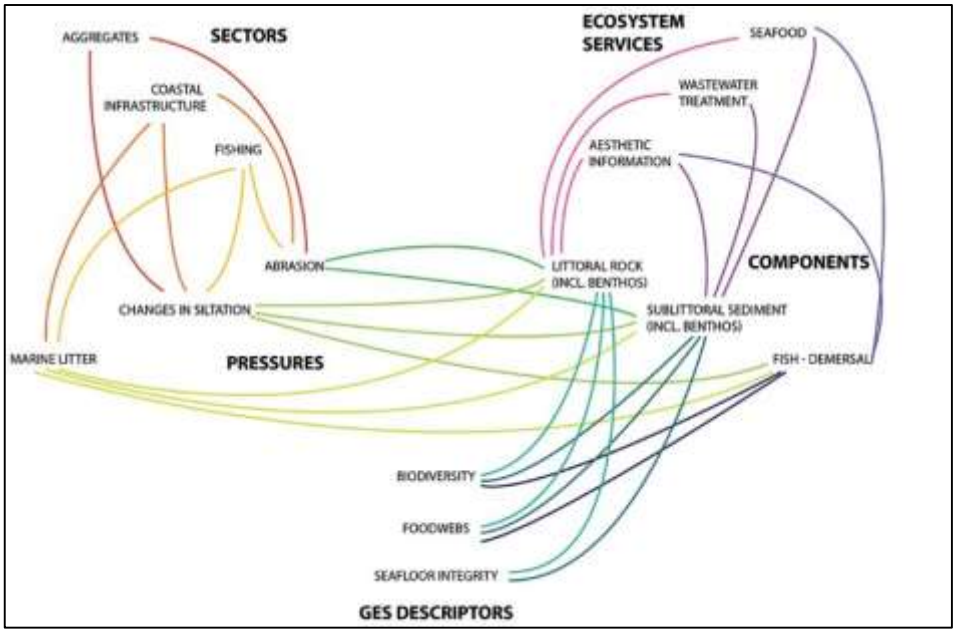

Figure 14. Subset example of the ODEMM Linkage Framework

Based on the components of the ODEMM approach, the implementation of a framework for ecosystem based transboundary MSP in the Celtic Seas to foster collaboration and coordination should be based on the following factors:

- Common Objective Setting
- Addressing Data Availability and Gaps
- Building on stakeholder engagement and perspectives
- Addressing Multi-Sectoral Conflicts

6.3.1. Common Objective Setting

The need to address a common crisis or to avail of mutually beneficial opportunities, may encourage actors in neighbouring jurisdictions to engage with one another (Erg et al., 2012). The identification of common issues and the collaborative formulisation of mutually beneficial solutions can also form the foundation for lasting transboundary cooperation on planning (Flannery et al., 2014).

The TPEA project further demonstrates that transnational planning would be more feasible in relation to discrete issues of common concern rather than a wide range of planning matters (Jay et al.,

2016). Common policy objectives and requirements in the MSFD and MSP Directive also serve as a driver for MS to cooperate in the implementation of an ecosystem based approach to marine management in the Celtic Seas. It is helpful to ensure that strategic objectives for transboundary MSP take into account the relevant legislation, policy and administrative structures (Jay et al., 2016).

6.3.2. Addressing Data Availability and Gaps

In a transboundary context, difficulties in the harmonisation of data from various jurisdictions is a significant practical problem when drawing data together from different administrative systems, processes and procedures. Experiences from the TPEA project shows that such technical challenges are multiplied in a transboundary context where information needs to be harmonised not just within, but also between jurisdictions. Issues such as variable scales of data collection, coordinate systems used and other data attributes require considerable additional effort when undertaking a joint-planning process (Jay et al., 2016). Findings from the ecosystem services case study work in ODEMM showed that there are also many data and/or knowledge gaps in terms of the ability to undertake quantitative analysis of ecosystem service supply and poor understanding of how the change in state of specific ecological components would result in a change of supply of specific ecosystem services (Robinson et al., 2014). A wider process of cooperation is required to address issues and challenges related to data harmonization and availability in the Celtic Seas. SIMCelt therefore seeks to build a Maritime Spatial Data Infrastructure (MSDI) for sharing and exchange of scientific data in support of transboundary cooperation for planning within the larger Celtic Seas region.

6.3.3. Building on Stakeholder Perspectives and Engagement

One of the primary principles of EBM is the early involvement of all relevant sectors and stakeholders. However, scaling-up MSP to incorporate the transboundary dimension increases some of the practical difficulties of securing adequate stakeholder engagement, such as identifying affected groups, gaining good representation, finding effective means of communication and dealing with conflicting interests (Jay et al., 2016). Good stakeholder relationships are crucial for achieving marine environmental objectives since the stakeholders themselves are the means for change (Pomeroy and Douvere, 2008; Ehler, 2008).

It is important to establish mechanisms to ensure regular involvement of key stakeholders at the transboundary level and which should function as a learning process to build a basis of understanding common to all stakeholders (Zaucha, 2014). In this report, existing statutory, non-statutory and voluntary stakeholder platforms that have been identified in the Celtic Seas will be used as basis on which to build stakeholder engagement in the SIMCelt project. This existing network of transboundary institutions brings the advantage of familiarity between key actors built through shared experiences in cross-border cooperation and established good working relations that such experiences may have engendered (Leibenath, 2010).

6.3.4. Multi-Sectoral Use Conflicts

For the ecosystem based approach to be applied successfully, multi-sectoral conflicts and the cumulative impacts of such multiple uses of space must be addressed through transboundary MSP. The ODEMM linkage framework can be used to identify management options that minimise the impact of

human activities on ecological components, whilst juxtaposing these against the demand for ecosystem services and the benefits arising from them. According to ABPmer (2016) areas where interactions between sectors are most pronounced in the Celtic Seas are the South Wales/Severn Estuary and Bristol Channel, Irish Sea and West coast of Scotland.

It is important that through a transboundary MSP process existing and projected multi sectoral use patterns and interactions are understood. Again spatial and/or temporal conflicts must be identified and characterised for procedures and tools to be developed to address these conflicts. The SIMCelt project through its case studies on cumulative impacts and ecosystem services seeks to build on knowledge and data to analyse multi sectoral patterns and interactions.

7. Conclusions

Historically, support for human activities in the Celtic Seas were limited to the traditional activities such as fishing and shipping activities. However, over the last two centuries a wider range of activities have emerged and the intensity of human activities have been recognised. Assessment of existing maritime activities and their future trends in this report shows an increase in the intensity of traditional and emerging maritime activities. Human activities such as fishing, aquaculture, coastal construction, land-based industry, maritime transport, agriculture, dredging, and offshore structures for renewable and non-renewable energy sources have been identified as major activities exerting pressure on the Celtic Seas ecosystem.

The EU's Maritime Spatial Planning Directive seeks to promote sustainable growth of maritime economies through the responsible use of finite marine resources. However, uncertainties remain regarding how the provisions of the Directive will be practically implemented. In particular, Article 7 will be key in making twin planning systems (terrestrial and maritime spatial planning) work together. Some Maritime Spatial Plans (e.g. Scottish National Marine Plan) contain provisions stating that marine planning shall be aligned with local development plans on land and further consideration as to how these provisions are going to work in practice is needed.

More compelling perhaps is the requirement that Member States sharing the same eco-region cooperate on issues of a transnational nature to ensure that maritime spatial plans are coordinated across the marine region in question. Developing the practical approaches and scope of that transboundary cooperation is left up to the discretion of Member States however the incompatibility in timing and objectives of MSP in individual MS highlighted here underlines the need for early and transparent cooperation to identify common objectives and priorities and agree a framework for transboundary implementation.

Building on existing, extant and previous institutions, projects and stakeholder forums identified in this report will be important for transboundary maritime spatial planning. Pilot projects on transboundary maritime spatial planning and stakeholder engagement (e.g. ODEMM, TPEA, PISCES and Celtic Seas Partnership) are therefore useful to assist Member States in the implementation of their obligations under the MSP Directive.

The role of SIMCelt in supporting transboundary and cross border cooperation for MSP is to bring together the data requirements, governance and stakeholder elements of MSP at the Celtic Seas level and develop best practices and methodologies for ensuring cooperation.

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Annex 1. Existing Maritime Spatial Plans and Related Projects in the Celtic Seas

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
Trans-bounday	Transboundary Planning in the European Atlantic (TPEA) Project	East Coast Irish Sea	Government, research centres and data agencies from the UK, Portugal, Spain, and Ireland	The project was part-funded by DG MARE and involved participation from four member states of the North Atlantic Basin. The TPEA Project was completed in 2014 and was a pilot process to explore stakeholder engagement, governance and legal frameworks, and data management for cross-border MSP exercises in two pilot areas, one of which is the East Coast between the Republic and Northern Ireland.	• Initial Assessment Report • Evaluation Process Report • Good Practice Guide • Pilot Areas Report • Conceptual Framework Report • Transboundary dimensions of maritime spatial planning: Fostering inter-jurisdictional relations and governance		Click here
	Celtic Seas Partnership (CSP)	Celtic Seas	WWF, NERC, Sea Web Europe, University of Liverpool, BODC, MaREI, EMRA	The CSP is successor of the WWF UK led LIFE+ PISCES project which brought together stakeholders from the Celtic Seas to develop a practical guide on implementing the ecosystem approach in the context of the MSFD. CSP aimed to draw together people from across the Celtic Seas to set up collaborative and innovative approaches to managing their marine environment.	• Future Trends in the Celtic Seas Baseline Report • Future Trends in the Celtic Seas Scenarios Report • Future Trends in the Celtic Seas Analysis Report • Best Practice Guidelines for Transboundary Marine-Governance		Click here
	ODEMM-Options for Delivering Ecosystem-	North East Atlantic Ocean	17 project partners across Europe's four regional seas -	The aim of ODEMM was to give an operational process of creating, appraising and choosing ecosystem-based marine management options. The	• The ODEMM Approach Report		Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
	Based Marine Management		Baltic Sea, Black Sea, Mediterranean Sea and the North East Atlantic Ocean	project used the principles of ecosystem based management in the development of the tools and models.	• ODEMM Linkage Framework.zip • Pressure Assessment Guide V2.pdf • ODEMM Ecological Risk Assessment Technical Report • Typology and indicators of ecosystem services for maritime spatial planning and management • Ecosystem-based marine management in European regional seas calls for nested governance structures and coordination—A policy brief		
	VALMER Project	Western Channel	11 partners from government institutions, universities and data agencies across the western channel	VALMER was an eleven partner, €4.7 million project co-funded under INTERREG IV A Channel programme through the European Regional Development Fund, which aimed to examine how improved marine ecosystem services assessment could support effective and informed marine management and planning. The project ran from 1st September 2012 to 31st March 2015.	• A Framework for the Operational Assessment of Marine Ecosystem Services • Ecosystem Service Assessment in Practice: Lessons Learned • Building Site Based Scenarios: Tools and Approaches for Implementation from the VALMER Project	VALMER data hub	Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
					• Transnational Scenario Synthesis: Results of the Scenario Building Processes Developed by VALMER's Case Study Sites • Improving Stakeholder Engagement in Marine Management through Ecosystem Service Assessment • The Potential Role of Ecosystem Service Assessment in Marine Governance in the Western Channel		
	Marine Atlantic Regions Network- MARNET	Atlantic Area	NWRA, SEMRU, University of Stirling, Region Bretagne, Ifremer, CIIMAR, University of Basque Country, AZTI	The aim of the Marnet project was to create an EU Atlantic marine socio-economic network that would develop a methodology to create and collate comparable marine socio-economic data across the Atlantic regions and to use this data to support marine socio-economic development initiatives along the Atlantic Area. The Network facilitates greater collaboration and knowledge exchange	• Developing a Comparative Marine Socio Economic Framework for the European Atlantic Area	Atlas of Marine Socio Economic Indicators	
UK	Irish Sea Pilot Project	Irish Sea	DEFRA/Joint Nature	The UK Government set up the Irish Sea Project in 2002 to test the potential for an ecosystem approach to managing the	• The Irish Sea Pilot Final Report		Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
			Conservation Committee	marine environment at a regional sea scale. The involvement of the Governments of Ireland, the Isle of Man, the devolved Administrations of the UK and many Irish Sea stakeholders contributed to the Pilot project.			
	Maritime spatial Planning Pilot	Irish Sea	DEFRA, ABPmer & MSPP Consortium	As part of Marine Stewardship initiative, Defra in 2004 commissioned a consortium comprising ABPmer, MSPP Consortium to research options for developing, implementing and managing MSP in the UK. The study included a literature review to identify international experiences of MSP and their applicability to the UK and a pilot project in the Irish Sea, to simulate the feasibility for the development of a regional and local plan.	• Maritime spatial Planning Final Report • Towards Maritime spatial Planning and Management • Maritime spatial Planning and Related Plans • Maritime spatial Planning Literature Review • Irish Sea Pilot Plan		Click here
Scotland	Scotland's National Marine Plan	National Plan	Marine Scotland	The Plan was adopted in 2015 and it covers both Scottish inshore and offshore waters. Scotland's inshore waters are governed by the Marine (Scotland) Act 2010, and its offshore waters by the Marine and Coastal Access Act 2009. The Scottish Government also aims to develop a series of regional marine plans extending out to 12 nautical miles through Marine Planning Partnerships. This will take account of local circumstances and smaller ecosystem units. The first Marine	• Scotland's National Marine Plan • Scotland's Marine Atlas - Information for the National Marine Plan • Sustainability Appraisal • Equality Impact Assessment • National Marine Plan - Lessons Learned	National Marine Plan Interactive (NMPi)	Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
				Planning Partnerships are ongoing in Shetland and Clyde.	• Business and Regulatory and Impacts Assessment • National Marine Plan - Monitoring & Reporting • Statement of Public Participation		
	Pilot Pentland Firth and Orkney Waters Maritime spatial Plan	Regional Pilot MSP	Marine Scotland	The Pentland Firth and Orkney Waters (PFOW) plan is a pilot which was used to test the implementation of the statutory process set out in the Marine (Scotland) Act 2010. The Highland Council and Orkney Islands Council have adopted the final pilot Plan as non-statutory planning guidance, acknowledging the status of the Plan as a material consideration in the determination of relevant planning applications.	• Pilot Pentland Firth and Orkney Waters Maritime spatial Plan Consultation Draft • Socio-Economic Baseline Review Consultation Draft • Sustainability Appraisal Consultation Draft • Regional Locational Guidance • Partial Business and Regulatory Impact Assessment (BRIA) • Equality Impact Assessment Record		Click here
	Scottish Sustainable Marine Environment Initiative	Local Pilot MSP	Shetland Islands Council & NAFC Marine Centre	Shetland Pilot MSP that has gone on to be adopted as a statutory instrument under the Shetland Islands Council's Local Development Plan as Supplementary Guidance in 2013	• Shetland Islands' Maritime spatial Plan • SIMSP Strategic Environmental Assessment - Environmental Report	SMSP GIS data	Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
	(SSMEI)-Shetland				• SIMSP Habitats Regulation Appraisal - Record • Review of the Maritime spatial Plan • Addressing cumulative impact in MSP • Review and Evaluation of MSP		
	SSMEI-Clyde	Local Pilot MSP	Clyde Marine Planning Partnership	The voluntary Firth of Clyde Maritime spatial Plan was developed as part of the SSMEI programme between 2006 and 2010 with the emphasis on consultation with stakeholders at all stages. The Firth of Clyde Maritime spatial Plan will be revised in phase 1 of the statutory regional marine plans in Scotland under the Clyde Marine Planning Partnership	• Clyde Maritime spatial Plan 2010 • Strategic Environmental Assessment – Non-technical summary • Lessons learned for Maritime spatial Planning • Interactions Matrix • Discussion paper – Applying the ecosystem approach to the FoC MSP • How can the Ecosystem Approach be applied Regional Marine Planning		Click here
England	MSP in England & East Marine Plans	Regional plans	MMO	There is no national plan for England however, MMO will produce marine plans for 11 marine plan areas across England. The first plans that have been	• East Inshore and East Offshore Marine Plans	Interactive Map	Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
				adopted are the East Inshore and East Offshore Marine Plans. Development of regional plans for Inshore and Offshore areas for the South of England, South West, South East and North East, and a combined Inshore/Offshore Plan for the North West are ongoing. Plans for the South Inshore and Offshore plans have already been issued out to public consultation.	• East Marine Plan Sustainability Appraisal • East Marine Plan Implementation and Monitoring Plan • Marine Information System (MIS) • Statement of Public Participation • Seascape character area assessment • Habitats Regulations Assessment		
Wales	The Welsh National Marine Plan	National Plan	Welsh Ministers	The draft Welsh National plan has been produced for the inshore and offshore areas of Wales with the possibility of embedding more local detail into the inshore plan at a later stage. Formal consultation on the Welsh National Marine Plan is expected to take place in mid-2017.	• Welsh National Marine Plan - Initial Draft - November 2015 • Welsh National Marine Plan - Sustainability review • Statement of Public Participation • A Spatial Assessment of the Potential for Aquaculture in Welsh Waters • Wales' Marine Evidence report	Wales Marine Planning Portal	Click here

Country	Project / Plan	Scale	Agency	Overview and Current Status	Project Documents	Data Portal	Website
					• Review of Aggregate Dredging off the coast		
North Northern Ireland	Marine Plan for Northern Ireland	National	Marine Plan Team-DAERA	DAERA is currently developing a single plan covering both inshore and offshore waters. A Sustainability Appraisal is also being undertaken to assist in the development of the Marine Plan	• Report on the Marine Plan process in Northern Ireland		Click here
[Republic of] Ireland	MSP in Ireland		Department of Housing, Planning, Community and Local Government & Marine Institute	The MSP Directive have been transposed into Irish law. The next step will be the development and finalisation of the practical arrangements to implement MSP in Ireland. A broad stakeholder engagement process will be undertaken	• Harnessing Our Ocean Wealth - An Integrated Marine Plan for Ireland • Towards an Integrated Policy Framework for Maritime spatial Planning in Ireland		Click here
France	MSP in France	Regional	Ministry for the Environment, Energy and the Sea	Maritime spatial Planning is to be implemented at the level of each Maritime façade through Maritime Front Strategy Documents which will be developed by 2018 by the pairs of Préfets in charge of the coordination of each French Maritime Front.	• Draft National Strategy for the Sea and the Seashore • Assessment of ecological values and activities in the Western English Channel		

Annex 2. Marine Governance Institutions and Stakeholder Forums in the Celtic Seas

Institution/Forum	Countries	Remit	Website
British - Irish Council (BIC)	UK, Ireland, Isle of Man, Guernsey & Jersey	Statutory institution for co-operation on matters of mutual interest within the competence of the relevant administrations	Click here
Loughs Agency	Northern Ireland (UK) & Ireland	Statutory regulator and enforcement Agency that ensures effective conservation, management and development of the fisheries and marine resources of the Foyle and Carlingford Areas (border bays)	Click here
OSPAR	UK, EU, France & Ireland	Statutory mechanism for collaboration by which Governments cooperate to protect the marine environment of the North-East Atlantic	Click here
North Western Waters Advisory Council	Ireland, UK and France	Legitimate EU fisheries stakeholder body which produces regular advice on its own initiative or at request of the EC and the concerned MS on all relevant matters related to fisheries management in the EC offshore waters within the EEZ of Ireland, part of the United Kingdom and France	Click here
ICES (International Council for the Exploration of the Sea)	Ireland, UK and France	Multidisciplinary scientific forum for the exchange of information and ideas on all aspects of marine sciences. ICES also provides advice on the marine ecosystem to governments and international regulatory bodies that manage the North Atlantic Ocean	Click here
Irish Sea Maritime Forum	UK incl. Isle of Man, and Ireland	A broad based forum for all Irish Sea users and stakeholders	Click here
Cross Channel Forum	England and France	The Cross-Channel Forum, was set up as part of the CAMIS and PEGASEAS projects, which enabled French and British 'sea and coastal' stakeholders to share views and exchange ideas about the future of the Channel area.	Click here
Solway Firth Partnership	Scotland & England	An independent charity that works to support a sustainable and vibrant local economy through respecting, protecting and celebrating the distinctive character, heritage and natural features of the Solway Firth	Click here
Severn Estuary Partnership	Wales & England	An independent estuary-wide partnership that works with both local and national stakeholders in promoting a sustainable approach to the planning, management, and development of the estuary	Click here
North West Coastal Forum	North-West England & North Wales	An independent multi-sector partnership of coastal stakeholders working to promote and deliver integrated coastal zone management along the North West's coast of England and Wales.	Click here