

Scotland's Marine Protected Area Network: Reviewing progress towards achieving commitments for marine conservation

Charlotte Rachael Hopkins ^{a*}

David Mark Bailey ^a

Tavis Potts ^b

*Corresponding Author

^a University of Glasgow, Glasgow, G12 8QQ, UK

^b Department of Geography and Environment, University of Aberdeen, AB24 3UF, UK

Abstract

Significant progress has been made towards implementing Marine Protected Area (MPA) networks in UK waters, with Scotland successfully designating 30 new Scottish MPA sites in July 2014. This paper reviews the Scottish MPA process up to the point of implementation, summarising the process that led to the designation of the MPA network. In particular, this paper investigates the extent to which the process i) effectively engaged stakeholders; ii) used ecological guiding principles; and iii) considered climate change. In doing so, this paper highlights several key issues if the Scottish MPA network is to move beyond an administrative exercise and is able to make a meaningful contribution to marine biodiversity protection for Europe: i) fully adopt best practice ecological principles ii) ensure effective protection and iii) explicitly consider climate change in the management, monitoring and future iterations of the network.

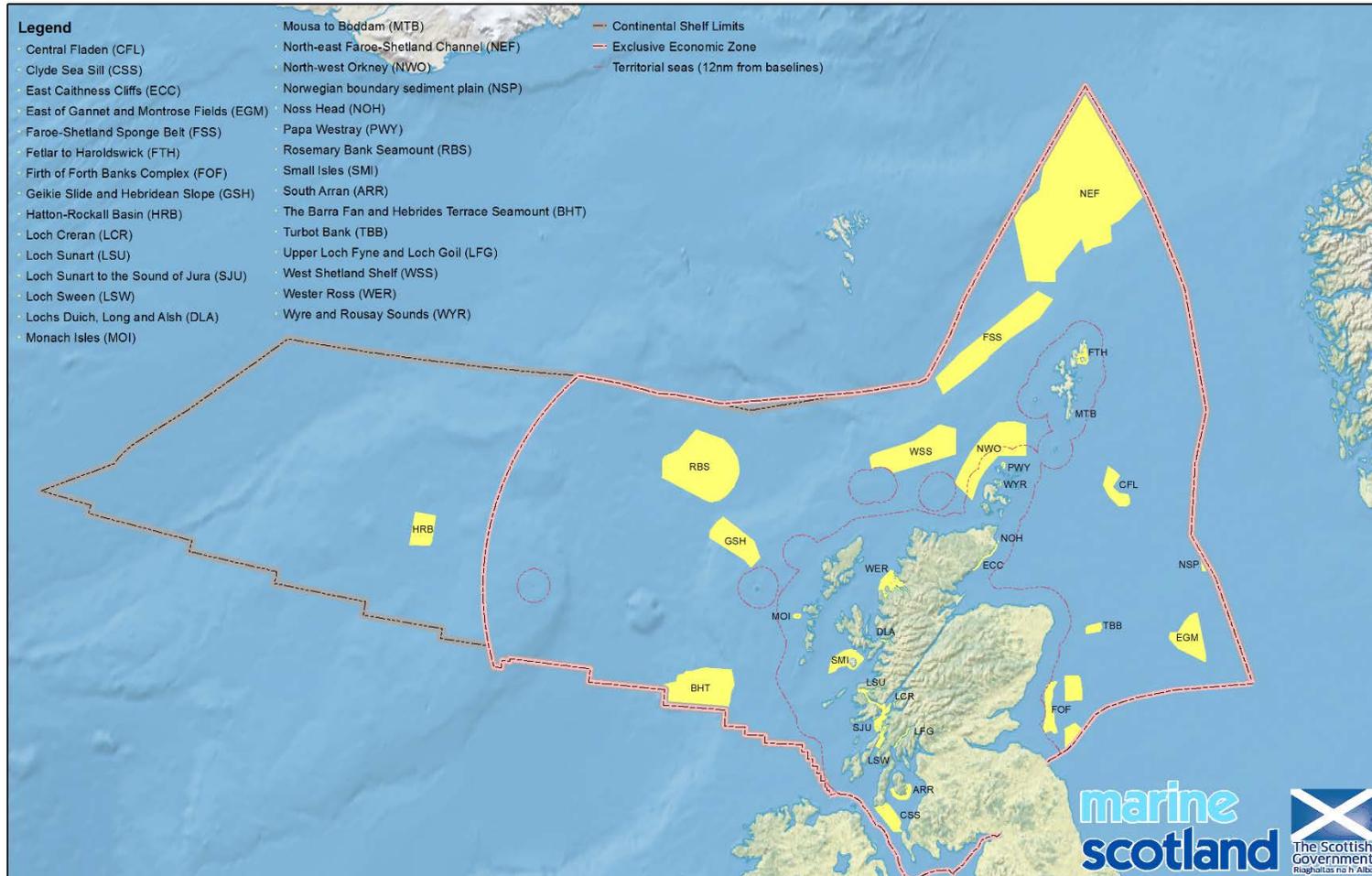
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1. Introduction

In response to international commitments and concerns regarding marine biodiversity loss, the designation of Marine Protected Areas (MPAs) within the European Union (EU), has gained impetus and Member States are increasing protection through spatially explicit tools to address conservation goals for the marine environment (Metcalf et al. 2013). European MPA coverage reached 4% in 2012 with an additional 1.9% of nationally designated sites (European Environment Agency 2015). Whilst there are significant differences in coverage between inshore and offshore waters, and varying levels of protection across the different EU regions (European Environment Agency 2012), this is still significant progress towards increasing marine protection. However, it is still far below the 10% targets set by the Convention on Biological Diversity (CBD 2006) and the UN Sustainable Development Goals (United Nations General Assembly 2015), and drastically below the 30% cover required for effective protection (O'Leary et al. 2016).

The coordination of such large scale, regional MPA networks is difficult. EU member states are implementing spatial marine protection on different timescales and under complex policy frameworks developed at both a European and national level (Haslett et al. 2010, Metcalfe et al. 2013). The UK is developing a network of MPAs as part of EU-wide efforts to increase spatial protection and substantial progress has been made towards a network through the devolved administrations (Jones 2012). Although the final shape of the UK-wide network is yet to be determined, the English Marine Conservation Zone (MCZ) Project resulted in the designation of 27 new MCZ sites in November 2013 and 23 new sites in January 2016. The Scottish MPA Process resulted in the designation of 30 MPAs in July 2014 (Figure 1). The Scottish MPA process is aiming to deliver the UK vision and Scottish Government's commitment to delivering a 'clean, healthy, safe, productive and biologically diverse marine and coastal environment that meets the long term needs of people and nature' (Scottish Government 2010).

Nature Conservation Marine Protected Areas (MPAs)



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Projection: Europe Albers Equal Area Conic. Datum: WGS1984. Scale 1:6,500,000 .

Figure 1. A map of the 30 new Scottish Nature Conservation MPAs designated July 2014. Reproduced with permission from Marine Scotland. Available at: <http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/MPAMap>.

However, despite the increasing implementation of MPAs worldwide, few processes are assessed in terms of the effectiveness of stakeholder engagement (but see (Voyer et al. 2012)), whether they are meeting ecological principles for network design and under the increasing threat of climate change, and whether they have been designed for persistence and resilience. Consequently, this paper reviews the Scottish Nature Conservation (NC) MPA (hereafter referred to as MPA) process up to the point of implementation by i) reviewing the policy framework under which the Scottish MPA network was developed; ii) critically examining the approach used for the selection of Scottish MPA sites; iii) highlighting future challenges for the Scottish MPA network and proposals for adapting the existing network to ensure that the network fulfils its objectives as a centrepiece for marine conservation.

2. Policy context

Scotland's MPA network is set against a backdrop of policy obligations and provisions at international, EU and UK levels (Table 1). The Convention on Biodiversity (CBD), the EU Habitats and Birds Directives and the OSPAR regional seas convention are the three key policy drivers for marine biodiversity conservation in Northern Europe (Metcalf et al. 2013). Additionally, supporting policies at the EU, UK and national level address marine protection in Scotland.

The development of MPAs in Scotland and the UK as a whole is framed by the implementation of the EU Marine Strategy Framework Directive (MSFD) (European Commission 2008), the aim of which is to manage human activities in the EU marine environment and to balance maritime development and resource use with environmental protection. It is a milestone in European marine policy (Salomon and Dross 2013) and as evidence towards the EU fulfilling its international obligations for the protection of the marine environment (Long 2011). Whilst the main goal of MSFD is to achieve "Good Environmental Status" (GES) of EU marine waters by 2020 (European Commission 2008), it gives legal force to the creation of networks of MPAs, measures for which should be in place by 2016, under such obligations as OSPAR and CBD (OSPAR Commission 2003, CBD 2004).

Table 1. A summary of International, European and UK marine conservation obligations and commitments

	Convention	Commitments of Contracting Parties	Commitment pertains to:	Deadline
International	World Summit on Sustainable Development (WSSD), Johannesburg, South Africa (United Nations 2002); UN Sustainable Development Goals (SDG) (United Nations General Assembly 2015)	Recommendation for an international representative network of MPAs At least 10% of coastal and marine areas conserved, “consistent with national and international law and based on the best available scientific evidence”. SDG target 14.5 (United Nations General Assembly 2015)	Global Ocean	2012; 2020
	5 th IUCN World Parks Congress, Durban, South Africa, (IUCN 2005)	Recommendation for a network of MPAs with 20-30% of total area strictly protected (IUCN 2005)	Global Ocean	2012
	7 th Conference of the Parties to the Convention on Biological Diversity, Kuala Lumpur, Malaysia (CBD 2004b)	A global network of “comprehensive, representative and effectively managed national and regional protected areas” (CBD 2004b)	Areas under National Jurisdiction	2012
EU	Oslo Paris Convention, Convention for the Protection of the Marine Environment of the North East Atlantic, (OSPAR Commission 2003)	Ecologically coherent network of MPAs in inshore and offshore EU waters	North-east Atlantic Areas under National Jurisdiction Areas beyond National Jurisdiction	Ecologically coherent network by 2010 Well managed network by 2016
	Marine Strategy Framework Directive (MSFD), (European Commission 2008)	Using ecosystem-based management member states required to put in place a programme of measures to achieve “good environmental status” (GES) in EU marine waters. Approach to achieve GES should include protected areas.	EU marine area Areas under National Jurisdiction	Achieve GES by 2020 Supports creation of global network of MPAs by 2012

	Habitats Directive (Directive 92/43/EEC); Birds Directive (Directive 2009/147/EC) (EC 1979, 1992).	Implementation of marine Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) contributing to Natura 2000 network of protected area sites. Implemented in the UK by the Habitat Regulations and main source of existing protected sites.	EU marine area Areas under National Jurisdiction	-
UK	Nature Conservation (Scotland) Act 2004	Creation of Sites of Special Scientific Interest (SSSIs) applicable to the low water mark.	Scottish coastal area applicable to the low water mark	-
	UK Marine Policy Statement Jointly adopted by the devolved administrations (HM Government 2011)	Framework for preparing marine plans. Does not call for MPAs but key management instrument in MPA effectiveness at EU scale Sets out the general environmental considerations that need to be taken into account in marine planning	UK marine area	Supports targets proposed under the MSFD e.g. achieve GES by 2020. Agreed to coordinate policies and measures with other countries e.g. OSPAR ecologically coherent network by 2012
	Marine and Coastal Access Act 2009	Devolved responsibility under this Act allows MPAs to be designated out to 200 nautical miles	UK marine area	2012
	Marine (Scotland) Act 2010	Legal mechanism in Scotland for designating MPAs. Legislation states the 'Minister <u>must</u> designate a network of MPAs'. Climate change	Scottish marine area (includes inshore and offshore waters out to 200nm)	2012
	Scotland's National Marine Plan (Scottish Government 2015a)	Provides an overarching framework for managing marine activities. General Objective 9 outlines that development and use of the marine environment must comply with legal requirements for MPAs	Scottish marine area (includes inshore and offshore waters out to 200nm)	-

Notwithstanding the uncertainty of how and to what extent MPAs will contribute to GES, MPAs are still considered a key mechanism to be used in attempting to achieve GES (Fenberg et al. 2012). The approach Member States take in order to achieve GES should include protected areas under *Article 13 (4)* of the MSFD (European Commission 2008) contributing to a coherent and representative network of MPAs. Including Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), designated under the Habitats Directive and the Birds Directive and jointly referred to as the Natura 2000 sites, Member States have made some progress towards establishing coherent MPA networks which are expected to contribute to the achievement of GES (European Commission 2008).

Under OSPAR, the primary regional seas agreement for the NE Atlantic, the UK agreed to contribute to developing an “ecologically, coherent network of well managed MPAs aiming to halt biodiversity loss in the marine environment” (OSPAR Commission 2003) in EU waters. The OSPAR Contracting Parties are responsible for nominating MPAs within their maritime boundaries and for providing progress reports towards designation. At a UK level the policy driver behind MPAs is the UK Marine Policy Statement (MPS) (HM Government 2011), the framework for preparing Marine Plans (National and Regional) and taking decisions affecting the marine environment (HM Government 2011). Joint adoption of the MPS by the devolved governments (UK Government, Scottish Government, Welsh Government and Northern Island Executive) has resulted in a high-level policy context framing the Scottish MPA process. Importantly the MPS represents a collective UK vision for the marine environment and the activities within it. Devolved legislators within the UK (Scotland, Wales, Northern Ireland) have agreed to develop planning and principles in alignment with the MPS.

2.1 Scotland’s Vision

The Scottish National Marine Plan (Scottish Government 2015a) outlines policies for the sustainable use of marine resources in Scotland, under the guidance of the MPS. It covers both inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles) as one document but under two pieces of legislation; the Marine (Scotland) Act 2010 and

the Marine and Coastal Access Act (2009). One of the general objectives of the National Marine Plan is that marine planning should comply with legal requirements for nature conservation, including protected areas. Importantly, through signing up to the vision of the MPS, additional powers for marine planning and establishing MPAs between the 12 and the 200 nautical mile limit were devolved to Scotland, an area originally under the jurisdiction of the UK Government under the Marine and Coastal Access Act (2009).

Scotland's vision for the marine environment is for a "clean, healthy, safe, productive and biologically diverse marine and coastal environment that meets the long term needs of people and nature" which includes the sustainable management of the sea to protect biodiversity and recover where practicable (Scottish Government 2011a). The vision for an ecologically coherent MPA network is outlined in The Strategy for Marine Nature Conservation in Scotland's Seas (Scottish Government 2011a) as part of a three pillar approach to conservation: species conservation, site protection and wider seas policies and measures which can contribute towards marine nature conservation (Scottish Government 2011a). The MPA network is intended to meet national objectives and international commitments and will consist of existing protected sites and newly designated MPAs.

The consideration of climate change is also included within the Marine (Scotland) Act 2010 with regards to the MPA network. Part 5 Section 68 (7) of the Act (Scottish Government 2010) states:

"In considering whether to designate an area, the Scottish Ministers may have regard to the extent to which doing so will contribute to the mitigation of climate change."

It is interesting to note that there is no reference to climate change adaptation either in terms of the role for MPAs in promoting resilience or in the need to take climate change into account in MPA designation or management. However, in a report to the Scottish Government providing advice to Ministers on the now designated Scottish MPA network, the Ministerial Foreword specifically mentions climate change: "Healthy seas also assist in protecting us from climate change" (Marine Scotland, 2012). With a clear mention of climate change at the beginning of the advisory report, and the first iteration of the MPA

network now complete, it is interesting to examine whether the same emphasis is given to the scientific considerations of MPAs and climate change throughout the Scottish MPA process. Additionally, the National Marine Plan deals with climate change on a sectoral basis, without particular consideration of the MPA network.

3. Scotland's MPA process

The Scottish MPA process was led by Marine Scotland Policy (a Directorate of the Scottish Government), with advice from Scottish Natural Heritage (SNH) and the Joint Nature Conservation Committee (JNCC) and input from Marine Scotland Science (MSS) through targeted research. In December 2012 the initial proposals for a network of MPAs surrounding Scotland were reported to the Scottish Parliament. The report from Marine Scotland outlined advice on the selection of proposed MPA sites for Scotland, reporting on the progress of a two-year process to design an MPA network for Scotland. Two additional designations that complete the Scottish MPA network: Historic MPAs and Research and Demonstration MPAs, are considered by a separate process and are thus not discussed in the context of the Nature Conservation MPA process. Five stakeholder workshops represent the pre-designation phase to the MPA process and included the collation of data, exploring potential spatial designations, the role of 'less damaged sites', inclusion of community nominated sites and early discussion on the ramification for day-to-day management (Table 2).

Table 2. Summary of the five Stakeholder Workshops of the Scottish MPA Process

Workshop	Date	Key Content
1. Ecological Data	March 2011	<ul style="list-style-type: none"> • Presentation of the ecological data collated prior to the workshop • Discussion of data gaps
2. Least Damaged More Natural (LDMN) Locations	June 2011	<ul style="list-style-type: none"> • Presentation of the LDMN approach to select MPA sites
3. Developing the MPA network	October 2011	<ul style="list-style-type: none"> • Presentation of the contribution of existing protected areas to the new MPA network; contribution of other area-based measures; LDMN locations • Preliminary network assessment and overview of MPA search locations
4. Identification of additional MPA search locations and discussion of search feature sensitivities	March 2012	<ul style="list-style-type: none"> • Discussion of additional MPA search locations (including Third Party Proposals¹) • Introduction of the use of feature sensitivities as a tool for starting discussions on potential management considerations for the future MPA sites.
5. Evolving shape of the network	June 2012	<ul style="list-style-type: none"> • Overview of the shape and development of the network proposals following Workshop 4 • Presentation of the process used to identify management options for the MPA sites

*Summary reports of the Stakeholder Workshops are available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/engagement/WorkshopReports>

¹Third Party Proposals: submitted prior to Workshop 4 covering 26 locations by organisations including: the Royal Society for the Protection of Birds (RSPB), Whale and Dolphin Conservation Society (WDCS), Marine Conservation Society (MCS) and Community Of Arran Seabed Trust (COAST), and were assessed against the MPA selection guidelines. Feedback suggested either the sites were submitted for further assessment, that further work would be needed to ascertain further assessment or that no further assessment should be made at that time (Scottish Government 2012a). Further third party proposals may be considered at the next 6 yearly review of the MPA network (Scottish Government 2012a).

3.1 Stakeholder engagement

Throughout the MPA network design process there was engagement in terms of strategic representation across sectors, that is, senior representatives of organisations or representation of industry clusters or interest groups (Scottish Government, 2012b). The five aforementioned stakeholder workshops operated on an invitation only process, with a limited number of stakeholder representatives in attendance due to venue size limitations and the practicalities of meaningfully engaging with participants. The discussion was tightly managed with limited time for “open ended” debate, focusing on specific questions related to the topic of each workshop, for example, the quality of existing data to support site designation. Although the stakeholder workshops were intended for key marine users, the supporting documentation was published on the Marine Scotland website.

Following the conclusion of the stakeholder workshops, the final advisory report from SNH and JNCC (Scottish Natural Heritage 2012), and the Report to Parliament on the development of the MPA Network (Scottish Government 2012b), was submitted to Ministers for consideration in December 2012, and preparation for the public consultation began. After Workshop 5 a Sustainability Appraisal was produced, comprising of a Strategic Environmental Assessment (SEA) and a socioeconomic assessment, summarising the impact of the potential individual MPAs and the potential MPA network as whole (see (Scottish Government 2012c)). Stakeholder engagement continued in the form of industry specific consultations. The public consultation was an important step in the process, likely to heavily influence the Ministerial decision. The formal consultation process on MPA proposals and the Sustainability Appraisal ran from July 2013 until November 2013 as part of a wider “Planning Scotland’s Seas” consultation. The consultation documents invited comments on the development of the whole MPA network, as well as site by site views, and provided information on the scientific evidence for each site, the possible management options (see (Scottish Government 2013a)) and the potential socioeconomic impacts (Scottish Government 2013b). There will be further opportunities for public and community engagement with the submission of additional site proposals. This will be accepted and considered post-designation at the first review of the network in 2018.

3.1.1 Critique

The European Union (EU) 2015 State of Europe's Seas report highlighted the great knowledge gap in determining the conservation status for marine species and habitats (European Environment Agency 2015). More than 70% of the species and 40% of the habitats of European interest in marine ecosystems are of unknown conservation status, and of those assessed only 7% of species and 9% of habitats are in a favourable state (European Environment Agency 2015). The need to improve the status of the marine environment, whilst balancing complex socio-economic and political interests is a documented facet of MPA implementation in Europe (van Haastrecht and Toonen 2011). The inclusion of stakeholders and resource users in the MPA process is important to the eventual effectiveness of MPAs, (Kelleher 1999, Pollnac et al. 2010), recognising that policy can fail through a lack of public engagement and a reluctance of decision makers and stakeholders to work together (De Santo 2016). Consultation and the right to participate in environmental decision-making, is in many countries a democratic requirement by law or policy (as it is in the EU under the Aarhus Convention), with the ultimate decision-making power and funding decisions retained by the government (Day 2002). Two things will be essential in the on-going Scottish MPA process for a successful management approach and stakeholder relations: the first is continued effective engagement with stakeholders and the second is transparency and accountability over decision-making (Jentoft et al. 2007). Previous protected area processes not having a high level of openness have engendered suspicion and distrust from communities (Brennan and Valcic 2012); concerns of both the level of transparency, the representativeness of stakeholders and the lack of influence have been raised in the English MCZ process (see Fletcher et al. (2014), Gaymer et al. (2014) and De Santo (2016)).

The interpretation from attending the workshops was one where a diversity of actors and interests were 'present at the table' but deeper dialogue over the implications of the potential sites was generally avoided. This may be reflective of the stage in the policy cycle. While stakeholders were interested, no final sites were proposed during the workshop aspect of the process, and this level of strategic assessment may have limited detailed discussion.

Engaging the parties whom MPAs will directly impact upon is often the easier task. Engaging the public throughout the process can prove more difficult, yet equitable consideration of all viewpoints is required to ensure a socially fair approach to MPA designation (Voyer et al. 2012). The public consultation on the MPA network was embedded in a full consultation of marine spatial planning and offshore renewable energy development. Presented with such a variety of marine issues and the sheer scale of consultation documents, a pertinent question is whether this was overwhelming for an average citizen and whether the issue of MPAs was lost in the noise and technical complexity. Delegating the task of engagement in this manner, assumes the public as a stakeholder is able to understand and navigate a complex political, regulatory and bureaucratic system (Voyer et al. 2012). Another concern is that the public engagement exercise was a process of unidirectional information giving rather than an engaged two-way discussion and commitment to explore communities managing their local resources. Additionally, the complexities of deeper social issues may be overlooked by framing public submissions in terms of support or opposition for the MPAs, a process that can be harnessed by large shrewd lobbying groups (Voyer et al. 2012).

The need for marine protection has been actively pushed up the political agenda through effective lobbying from the non-governmental organisation (NGO) community (Peel and Lloyd 2009). The majority of public consultation responses (14,371 out of a total of 14,703 responses) were in the form of postcard-style campaign text, (Mulholland and Granville 2014) in reference to 11 campaigns promoted by various organisations. Lobbying has been effective in a political sense but a clear gap remains over more meaningful engagement with the general public and coastal communities who are affected both positively and negatively by the newly designated MPA network.

3.2 Inclusion of guiding ecological principles

The scientific guidelines for the Scottish MPA process are based on the OSPAR principles for designing an ecologically coherent network that include: representivity, connectivity and resilience (OSPAR Commission 2006). The working definition of an ecologically coherent network (as proposed by OSPAR (2007)) emphasises that the network should interact with

and support the wider environment, maintain protected features and their processes/functions across their natural range (Laffoley et al. 2006) and the designated sites should function as a network rather than as individual areas of protection. Additionally, it is suggested that “[t]he network *may* be designed to be resilient to changing conditions” (OSPAR 2007); it is interesting to note the use of “ may” as opposed to “should” in the OSPAR guidance.

In the context of OSPAR’s working definition and associated assessment criteria for ecological coherence, Scotland’s MPA network is designed to “conserve a scientific selection of both marine biodiversity (species and habitats) and geodiversity (the variety of landforms and natural processes that underpin the marine landscapes), offering long-term support for the services our seas provide to society” (Scottish Government 2012b).

Scottish MPA sites were selected using a feature based approach in which MPAs “will be used to recognise locations of habitats or species which are important, rare, threatened and/or representative of the range of features in the UK marine area” (Scottish Government 2011b). This resulted in a list of species and habitats that were considered of marine nature conservation importance for which both area and non-area based measures of protection would be appropriate (termed Priority Marine Features (PMFs)) (Howson et al. 2012). The list of PMFs was developed by SNH on behalf of Marine Scotland in order to focus marine conservation efforts, not as a replacement for previous lists (Scottish Natural Heritage 2010), and was presented at the first stakeholder workshop. The list was compiled as an amalgamation of critical species and habitats lists from varying pieces of legislation and expert opinion (see peer review consultation Howson et al. (2012)). Public consultation on the list of PMFs ran from July to November 2013 (see PMFs Consultation Responses, Scottish Government (2013c)). Increasingly new terminology was added to the process: a list of MPA Search Features was created composed of selected PMFs that JNCC, Marine Scotland and SNH suggested could benefit from spatial protection measures (Scottish Natural Heritage 2010). MPA search locations could then be identified based on the presence of the MPA search features. The decisions regarding which PMFs would be MPA search features had major implications for the design of the network.

During the second workshop stakeholders were presented with the concept of selecting MPA search locations that were considered “Least Damaged/More Natural (LDMN)” (see (Chaniotis et al. 2011)). An LDMN location is defined in the MPA Selection Guidelines as “a marine area in which there has been little activity and which may therefore be in a relatively natural state” (Scottish Government 2011b). This concept resulted from the “Sustainable Seas for All” report (Scottish Government 2008) that recommended a number of broad policy approaches and suggested prioritising sites that were richest in marine biodiversity, possibly those least damaged (Scottish Government 2008). Once the MPA search locations were selected, they were then assessed against the MPA selection guidelines (Scottish Government 2011b). Additionally, upon the designation of the MPA sites, an independent scientific review (see Earnshaw et al. (2014)) reviewed the MPA process documentation and information in order to evaluate the appropriateness of each stage of the assessments for the sites.

3.2.1 Critique

The use of OSPAR’s “ecologically coherent” network design as a scientific framework is laden with challenges for assessing whether ecological coherence has been met or indeed, can ever be met (Ardron 2008, Jones and Carpenter 2009). The guiding OSPAR principles for network design including: representation, replication, and connectivity are well cited within MPA literature as best practice (reviewed in McLeod and Salm (2008), Gaines et al. (2010)) and were also applied in the design of England’s MCZ network proposals. The use of these principles is understandable as they guide network design pragmatically, avoiding stalling the process with an “unfeasibly rigorous” approach (Jones and Carpenter 2009). Consequently, it is important to assess to what extent these principles have been incorporated into the design of the Scottish MPA network.

Firstly, the issue of representivity within the Scottish network has been contentious, several respondents to the public consultation suggesting that the network would never be ecologically coherent without a greater representation of species and habitats present in Scotland’s seas (Mulholland 2014, Mulholland and Granville 2014). Indeed, respondents criticised the selection of only 39 species offered direct protection by the network,

suggesting this would not be representative of the approximate 6500 species and habitats in the Scottish marine area (Mulholland and Granville 2014). Conversely, the mobile fishing industry questioned the inclusion of species and habitats that did not appear on the OSPAR Threatened/Declining List as supporting items for MPA designation (Mulholland and Granville 2014). The fishing industry also challenged the legal basis for more than two replicate MPA sites per feature; this was refuted by the Scottish Government, stating that the provision in the Acts (see above) did not limit the number of MPAs for any given feature (Scottish Government 2015b).

However, the public consultation on the list of PMFs attracted only 31 responses, 4 from individuals and 27 from organisations (Costley 2014). By comparison the public consultation on possible NC MPAs attracted 14, 703 responses, yet still with a large majority of organisation responses rather than individual comments. The timing of public consultation on the PMF list, concurrent with the MPA public consultation, meant that any meaningful changes to the list would not be in time to influence conservation action for prioritised species and habitats in the first round of MPA designation.

Additionally, the rationale for which PMFs became MPA search features is unclear. Some rationale is provided on a species level, for example, the rationale for not progressing cod (*Gadus morhua*) and whiting (*Merlangius merlangus*) from a PMF to an MPA search feature: “advice from MSS was that an extremely large area would need to be managed for these species in order to be effective” (Scottish Natural Heritage 2010). However, other highly mobile species such as basking sharks (*Cetorhinus maximus*) were included as MPA search features which suggests, at least, that this reasoning has not been applied consistently.

The MPA network is part of the Scottish Government’s three-pillar approach to conservation, and spatial protection is only one part of the programme of measures contributing to the achievement of GES across the suite of marine biodiversity under the MSFD. It is therefore important to assess whether the network is truly representing the suite of marine biodiversity in order to maintain ecosystem function across the network. Ecological processes that are difficult to define spatially (De Santo and Jones 2007) which are not included in a species and habitats lists, but are important to the functioning of the

ecosystem, are a key component in ecological coherence. Considering how populations are connected across the network is critical in ensuring the resilience of populations and ecosystem integrity within and amongst ecosystems (Botsford 2001, Gaines et al. 2003), and is increasingly recognised as a crucial element for climate change resilience (Magris et al. 2014, Andrello et al. 2015). Yet, within the Scottish process, MPA sites were chosen, proposed and approached designation prior to any formal assessment of connectivity between them. By tying individual sites to the provable presence of specific features (species and habitats), the reasons for selecting sites became difficult to criticize and enabled discussions of management and connectivity, discussions that are usually contentious and subjective, to be pushed back to a point after which the network itself had been designated. This is suggestive of the claim that stakeholder participatory processes can become “talking shops” creating ambiguities and delaying decisive action (Reed 2008).

The independent scientific review (see Earnshaw et al. (2014)) recognises that connectivity and functional linkages have only been assessed for some large scale features and highly mobile species and has not been considered for static species so far. In reference to static features such as flame shell beds (*Limaria hians*), the review considers, under assessment of linkages, that “the feature is a significant habitat of itself”, the implication being that connectivity is not relevant to this species, despite being a biotic feature with its own population dynamics. As such no formal connectivity assessment has been conducted between the different flame shell habitats across the network, which is problematic for the conservation of habitat-forming species. Data requirements for designing and assessing connectivity are large and understanding is currently limited (e.g. lack of data on the dispersal potential of species and complex, uncertain hydrodynamics (Jones and Carpenter 2009)), therefore the emphasis has been to move forward with available information ((Jones and Carpenter 2009). However, there has also been progress in considering how different populations and habitats are connected across networks (e.g. Jones and Carpenter (2009), Jonsson et al. (2016)), and Scotland should demonstrate more formal connectivity considerations that network will not follow guidelines for international best practice (Almany et al. 2009, Olds et al. 2012, Magris et al. 2014).

In terms of the LDMN approach, concerns were expressed both at the stakeholder workshops and through the public consultation that there would be: i) an emphasis on lower value sites, e.g. sites with less biodiversity that had therefore attracted little fishing effort; ii) a lack of coverage along the Scottish coastline where activity is intense; iii) neglect of sites that had high biodiversity value but were in need of restoration or recovery; and iv) maintenance of status quo rather than improvement of damaged areas. As the shape of the network evolved and the search locations were identified, the potential LDMN areas were not considered sufficient to fully complete the network (Chaniotis et al. 2011) and further sites, perhaps in more heavily used areas, were necessary to represent the selection of species and habitats to be protected by the network. Therefore, some of these initial concerns seem not to have been borne out as the design process progressed.

3.3 Consideration of climate change

Although it was a progressive step to include a reference to climate change in the Marine (Scotland) Act, the statement remains vague regarding what would constitute the extent that climate change would be considered and it also hinges on mitigation of climate change rather than adaptation or resilience. Throughout the MPA stakeholder workshops there was limited mention of climate change, with little to no reference of how climate change was influencing the design of the MPA network. There was no mention of any site being designated for a particular species or habitat that was vulnerable to climate change. Important to note is that in the fourth stakeholder workshop, three third party proposal sites, submitted by the Whale and Dolphin Conservation Society (WDCCS) for the protection of white beaked dolphin (*Lagenorhynchus albirostris*), were excluded from further assessment due to “suspected changes in distribution linked to climate change” (Scottish Government 2012a).

3.3.1 Critique

The inclusion of the reference to climate change in the Scottish Marine Act is a pivotal step forward for the inclusion of climate change in marine conservation planning. Previous

protected area legislation, e.g. EU Habitats and Birds Directives, only addressed climate change indirectly through other indicators of ecosystem health (Cliquet et al. 2009). Whilst there is a clear framework of robust scientific guidelines which address climate change impacts indirectly, e.g. need for robust populations and protected areas, addressing non-climatic threats to increase resilience, only recently has there been an attempt at interpreting the EU legislation from a climate change context (see Trouwborst (2011)). The prominence of this new inclusion is highlighted by the UK High Level Marine Objectives (HLMO): General Objective 19 “Developers and users of the marine environment should seek to minimise emissions of greenhouse gases. Marine planning should seek to increase resilience of the marine environment to climate change impacts by reducing human pressure, safeguarding significant examples of natural carbon sinks and allowing natural coastal change where possible.”

As a strategy to mitigate climate change impacts, it is recommended that significant examples of natural carbon sinks be protected. However, whilst there has been an attempt at assessing the levels of “blue carbon” across Scotland (see Burrows et al. (2014)), there seems to be little integration with this assessment and the protection of these sites in the MPA network. A second strategy for the inclusion of climate change considerations across the network would be to ensure that the whole suite of marine biodiversity is effectively protected to increase resilience in the face of climate change impacts. Yet, it is difficult to see how the Scottish MPA network has paid specific attention to ensuring the resilience of the marine environment with reference to climate change.

Additionally, the suspension of site proposals for a species (white beaked dolphin) likely to be impacted by climate change, on the basis of the requirement for further evidence, raised concerns amongst stakeholders (Scottish Environment LINK 2013). This perhaps highlights that in the face of uncertainty and given the need for all decisions to be justified to a complicated and forceful stakeholder pool, an evidence-based approach was favoured over the precautionary principle.

Whilst there is a growing body of scientific literature on designing climate change resilient MPA networks (McLeod et al. 2009, Brock et al. 2012, Green et al. 2014, Magris et al. 2014,

Andrello et al. 2015), designing the network at a policy level is at odds with practical and successful implementation if the policy fails to address some of these scientific recommendations. With climate change ever present in the consciousness of conservation planners, how the proposed Scottish MPA network will perform under changing conditions is a key question. It will be increasingly important to assess how well the network is protecting marine biodiversity and whether the network is best designed and managed to ensure climate change resilience under future scenarios. Yet, how the network will be reviewed is still unclear and without clear assessment of the designated areas in the light of the MSFD and Scottish objectives for the network, it will be difficult to comment on the effectiveness of the MPA network. Assessing how the network is performing on short and long-term time scales will be an important challenge.

4. Discussion

4.1 Successes in Scottish MPA policy

Overall, the Scottish MPA process has resulted in the successful implementation of 30 new MPA sites following a comparatively fast-paced process, that built on existing areas and created a new MPA designation with a strong legal basis. The key action now is to ensure that future iterations of the network fill in gaps in protection, adapt to changing conditions and ensure that the new designations are properly managed and enforced. There are limited examples of apparently successful MPA processes on a regional scale (Gleason et al. 2010, Osmond et al. 2010) and it is difficult to generalise the recipe for success due to the highly context-dependent nature of such processes (Gleason et al. 2010, Bennett and Dearden 2014).

To implement an MPA or MPA network requires a complex mix of science, policy and stakeholder participation (Gleason et al. 2010), and it is perhaps better to recognise the role that each of these has in driving forward an MPA process rather than single out a specific element. Deemed a “science-led” process, perhaps the Scottish process would be better labelled “evidence based”, a process that used the “best” available scientific or survey data

to guide selection but with a degree of top down decision-making. The problems of shifting from “best available evidence” to “evidence-based” feature by feature approaches highlighted by Lieberknecht et al. (2013) encountered in the MCZ process, are also evident in the Scottish process. The data requirements are huge to provide detailed scientific evidence on presence, extent and condition of individual species and habitats, effectively precluding large areas with no recent detailed information available (Lieberknecht et al. 2013), ultimately undermining the ecological coherence of the network. However, this was also an approach that was pragmatic and robust in the face of a complicated stakeholder pool, one that had a solid legislative mandate and clear political will to push towards implementation.

4.2 Adopting key components of best design practice

A facet of previous successful MPA processes has been the setting of quantitative targets and goals (Metcalf et al. 2013) essential for measuring progress towards achieving the overall rationale for the MPA network (e.g. broad scale habitat targets in the MCZ process (Jones 2012)). Whilst there are broad goals for the Scottish network, individual targets for MPA habitats and species within the network have not been set (Marine Scotland 2012), and the network as a whole had no predetermined targets for the percentage of a feature needing spatial protection, or percentage area covered by MPAs. Values assigned to percentage cover are context dependent, for instance, some rare or sparsely distributed species may require higher levels of protection to ensure viability (Greathead et al. 2014) and there are cautions to following a threshold value approach (Agardy et al. 2003). The Scottish process, like the English process, followed an “adequacy” principle, determining the size of an MPA based on the whether it would be sufficiently large enough to protect the feature and /or achieve the ecological objectives. This principle seems subjective and does not appear to be based on any formal consideration of species-area relationship, viable population sizes or movement ranges of species (Scottish Government 2011b). Because connectivity has not been formally quantified, the sites in the network are assumed to be self-replenishing, isolated areas of protection, whereas this may not be the case.

Each MPA has an objective of either 'conserve' or 'recover' referring to the features for which the site is designated. These objectives, if not supported by more detailed targets for monitoring are vague and difficult to measure. This is especially true under future scenarios of climate change, for example, whereby it may become increasingly difficult to achieve such an objective (Cliquet et al. 2009). Likewise, under the MSFD determining GES should be in line with prevailing conditions and the determination of GES may have to be adapted over time as these conditions change (European Commission 2008). Therefore, measures for protection (i.e. the MPAs) and management should be flexible and adaptive, and regularly updated reflecting new scientific information (European Commission 2008). As such the future assessment of whether Scottish MPA sites are achieving the conservation objectives and how they contribute to GES should acknowledge the dynamic nature of marine systems. A criticism of the network in achieving GES is the use of the Least Damaged/More Natural concept to select sites; it is unlikely that a network based on undamaged areas would aid the attainment of GES. A central facet of conservation strategies has been to protect both areas of intact undamaged biodiversity and target those areas facing high human pressure (Myers and Mittermeier 2000, Singleton and Roberts 2014).

Recovery of the marine environment through the use of MPAs is explicitly referred to in the OSPAR guidelines (OSPAR Commission 2006), and there is an obligation to "where practicable, restore ecosystems in areas where they have been adversely affected" under the general provisions of the MSFD (European Commission 2008). Recovery is scientifically possible but often politically impractical and including the issue of current baseline data for recovery options, raised in the stakeholder workshops, can be even harder to achieve (Mee et al. 2008). With the predominant UK marine habitats being reported as "in poor status" and a risk level of moderate in terms of GES (Breen et al. 2012), recovering certain habitats under the Scottish MPA network could be extremely effort-intensive in the face of limited resources. There needs to be clarification on the link between the overall aim of the MPA network to help achieve GES and improve the wider status of species and habitats, with the conservation objectives at a site level. If the MPAs are intended to contribute widely to improving marine biodiversity rather than function as islands of protection, then a detailed consideration of the connectivity between sites and management of activities outside of those sites will be needed.

4.3 Ensuring effective protection

The management guidance delivered for the public consultation suggested that, in most cases, existing sectoral measures, such as fishery closures, would likely be enough to achieve conservation objectives (Scottish Government 2013a). There is also the presumption that MPA sites would be multiple-use and additional management measures may not be required if activities (or the absence of activities) are having no impact upon the conservation objectives. However, this approach has been criticised by conservation NGOs for supporting the 'status quo' rather than actively regenerating biodiversity across the network (Mulholland and Granville 2014).

Within the public consultation was an opportunity for more detailed site-based debate, the individual sections attracting varying responses and patchy attendance, but overall the designation and management options were seen to be supported by those who commented (Mulholland and Granville 2014). However, there were also repeated calls for clarity on management measures at the level of individual sites at the time of the public consultation. Additionally, the independent scientific review states that whilst the review agreed with proposed sites for designation, based on the available evidence, the value of any given MPA would be dependent upon the protection afforded by the management measures (Earnshaw et al. 2014). Site by site management discussions are now progressing, with the management approach being tied to a feature's susceptibility to different types of human activity (e.g. sensitivity to various gear types). This approach to management measures results in non-uniform regulations across the site, as specific management measures are justified on the physical presence of a feature within the site. This is comparable to the English MCZ process whereby the approach becomes fundamentally counter-intuitive to ecosystem-based management, neglecting site integrity and an overall vision for the MPA network (Liberknecht et al. 2011). Arguably this approach leaves little room for recovery, range expansion or risk of damage if management measures are strictly delineated on known feature presence data.

Attributing any impacts to the species and habitats within the MPAs to climate change in the face of continued human impacts and in the absence of reference areas is also likely to be extremely challenging or near impossible. The concept of “no-take zones”(NTZs) or fully protected marine reserves was explicitly and controversially ruled out in an FAQ document, early in the process (see Marine Scotland (2012)) as it was at a later stage in the English first tranche MCZ consultation. The FAQ document specified that although there was no intention to create NTZs, certain activities may be restricted to ensure the achievement of the MPA conservation objective. Whilst in some circumstances the designation of an NTZ neglects the uncontrolled use and persistent degradation of the marine environment outside the designated area (Agardy et al. 2003), there is a lingering question over whether it is possible to deliver ecosystem services and maintain ecosystem functions (and resilience) without some completely untouched pristine reference areas. Scotland’s approach throughout has been very species and habitat based rather than having a focus on ecosystem function highlighting the conflict between existing nature conservation policy and “the need for legal certainties for stakeholders” (Cliquet et al. 2009). Scotland’s approach calls into question whether a narrow focus on species and habitats rather than an ecosystem level and services approach or a clearer focus on site integrity, can ever achieve ecological coherency across the MPA network.

5. Conclusions

A common characteristic of successful MPAs is effective protection with an implicit recognition of an ecosystem approach. The feature-led approach to designation and management of Scotland’s MPA network may achieve success, but only if protection of those features is effectively enforced and the need to maintain whole site integrity is recognised. If these conditions are not met, the high level conservation objectives of achieving a coherent network, promoting resilience and recovery of marine areas appear difficult to achieve. To adequately protect Scottish seas from the increasing impacts of climate change, it is critical that the MPA network be coherent and resilient.

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References

- Agardy, T., P. Bridgewater, M. P. Crosby, J. Day, P. K. Dayton, R. Kenchington, D. Laffoley, P. McConney, P. A. Murray, J. E. Parks, and L. Peau. 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. *Aquatic Conservation: Marine and Freshwater Ecosystems* 13:353–367.
- Almany, G. R., S. R. Connolly, D. D. Heath, J. D. Hogan, G. P. Jones, L. J. McCook, M. Mills, R. L. Pressey, and D. H. Williamson. 2009. Connectivity, biodiversity conservation and the design of marine reserve networks for coral reefs. *Coral Reefs* 28:339–351.
- Andrello, M., D. Mouillot, S. Somot, W. Thuiller, and S. Manel. 2015. Additive effects of climate change on connectivity between marine protected areas and larval supply to fished areas. *Diversity and Distributions* 21:139–150.
- Ardron, J. A. 2008. The challenge of assessing whether the OSPAR network of marine protected areas is ecologically coherent. *Hydrobiologia* 606:45–53.
- Bennett, N. J., and P. Dearden. 2014. From measuring outcomes to providing inputs: Governance, management, and local development for more effective marine protected areas. *Marine Policy* 50:96–110.
- Botsford, L. W. 2001. Dependence of sustainability on the configuration of marine reserves and larval dispersal distance. *Ecology Letters* 4:144–150.
- Breen, P., L. A. Robinson, S. I. Rogers, A. M. Knights, G. Piet, T. Churilova, P. Margonski, N. Papadopoulou, E. Akoglu, A. Eriksson, Z. Finenko, V. Fleming-Lehtinen, B. Galil, F. Goodsir, M. Goren, O. Kryvenko, J. M. Leppanen, V. Markantonatou, S. Moncheva, T. Oguz, L. Paltriguera, K. Stefanova, F. Timofte, and F. Thomsen. 2012. An environmental assessment of risk in achieving good environmental status to support regional prioritisation of management in Europe. *Marine Policy* 36:1033–1043.
- Brennan, R. E., and B. Valcic. 2012. Feature Article: Shifting perspectives – How the masks we wear can facilitate and inhibit channels of communication in the social–environmental policy context. *Ocean & Coastal Management* 62:1–8.
- Brock, R. J., E. Kenchington, A. Martinez-Arroyo, and (Editors). 2012. *Scientific Guidelines for Designing Resilient Marine Protected Area Networks in a Changing Climate*. Commission for Environmental Cooperation. Montreal. Canada.
- Burrows, M., N. Kamenos, and D. Hughes. 2014. Assessment of carbon budgets and potential blue carbon stores in Scotland’s coastal and marine environment. Scottish Natural Heritage Commissioned Report No. 761.
- CBD. 2004. (DecisionVII/5 Marine and Coastal Biological Diversity) Convention on Biological Diversity. Kuala Lumpur, Malaysia. Available from:

<http://www.cbd.int/decision/cop/?id=7742>.

CBD. 2006. Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at its Eighth Meeting (Decision VIII/15, Annex IV). Convention on Biological Diversity, Curitiba, Brazil.

Chanotis, P., O. Crawford-Avis, S. Cunningham, K. Gillham, D. Tobin, and M. Linwood. 2011. Identifying locations considered to be least damaged/more natural in Scotland's seas. Final report produced by the Joint Nature Conservation Committee, Scottish Natural Heritage and Marine Scotland for the Scottish Marine Protected.

Cliquet, A., C. Backes, J. Harris, and P. Howsam. 2009. Adaptation to climate change: Legal challenges for protected areas. *Utrecht L. Rev.* 5:158–175.

Costley, N. 2014. Planning Scotland's Seas : Priority Marine Features (PMF) Analysis Of Consultation Responses. Available from <http://www.gov.scot/Resource/0044/00448654.pdf>.

Day, J. C. 2002. Zoning—lessons from the Great Barrier Reef Marine Park. *Ocean & Coastal Management* 45:139–156.

Earnshaw, S., R. Perez-Dominiguez, T. Worsfold, S. Pears, M. Hubble, R. Blyth-Skyrme, E. Wells, V. Blyth-Skyrme, J. Hall-Spencer, and M. Rehfish. 2014. Independent Science Review of the Scottish Marine Protected Areas Network. APEM Scientific Report for The Scottish Government. Available from: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/developing/ScienceReview>.

European Commission. 2008. European Commission Directive 2008/56/EC of the European Parliament and of the Council 17 June 2008, establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). *Official Journal of the European Union* L164:19–40.

European Environment Agency. 2012. Protected areas in Europe—an overview. EEA Report No. 5/2012.

European Environment Agency. 2015. State of Europe's seas. EEA Report No. 2/2015.

Fenberg, P. B., J. E. Caselle, J. Claudet, M. Clemence, S. D. Gaines, J. Antonio García-Charton, E. J. Gonçalves, K. Grorud-Colvert, P. Guidetti, S. R. Jenkins, P. J. S. Jones, S. E. Lester, R. McAllen, E. Moland, S. Planes, and T. K. Sørensen. 2012. The science of European marine reserves: Status, efficacy, and future needs. *Marine Policy* 36:1012–1021.

Fletcher, S., R. Jefferson, G. Glegg, L. Rodwell, and W. Dodds. 2014. England's evolving marine and coastal governance framework. *Marine Policy* 45:261–268.

Gaines, S. D., B. Gaylord, and J. L. Largier. 2003. Avoiding current oversights in marine reserve design. *Ecological Applications* 13:32–46.

- Gaines, S. D., C. White, M. H. Carr, and S. R. Palumbi. 2010. Designing marine reserve networks for both conservation and fisheries management. *Proceedings of the National Academy of Sciences of the United States of America* 107:18286–18293.
- Gaymer, C. F., A. V. Stadel, N. C. Ban, P. F. Cárcamo, J. Ierna, and L. M. Lieberknecht. 2014. Merging top-down and bottom-up approaches in marine protected areas planning: experiences from around the globe. *Aquatic Conservation: Marine and Freshwater Ecosystems* 24:128–144.
- Gleason, M., S. McCreary, M. Miller-Henson, J. Ugoretz, E. Fox, M. Merrifield, W. McClintock, P. Serpa, and K. Hoffman. 2010. Science-based and stakeholder-driven marine protected area network planning: A successful case study from north central California. *Ocean & Coastal Management* 53:52–68.
- Greathead, C., J. Gonzales-Irusta, J. Clarke, P. Boulcott, L. Blackadder, A. Weetman, P. J. Wright, and J. M. Gonza. 2014. Environmental requirements for three sea pen species: relevance to distribution and conservation. *ICES Journal of Marine Science*:doi:10.1093/icesjms/fsu129.
- Green, A. L., L. Fernandes, G. Almany, R. Abesamis, E. McLeod, P. M. Aliño, A. T. White, R. Salm, J. Tanzer, and R. L. Pressey. 2014. Designing Marine Reserves for Fisheries Management, Biodiversity Conservation, and Climate Change Adaptation. *Coastal Management* 42:143–159.
- van Haastrecht, E. K., and H. M. Toonen. 2011. Science-Policy Interactions in MPA Site Selection in the Dutch Part of the North Sea. *Environmental Management* 47:656–670.
- Haslett, J. R., P. M. Berry, G. Bela, R. H. G. Jongman, G. Pataki, M. J. Samways, and M. Zobel. 2010. Changing conservation strategies in Europe: a framework integrating ecosystem services and dynamics. *Biodiversity and Conservation* 19:2963–2977.
- HM Government. 2011. UK Marine Policy Statement. Available from <https://www.gov.uk/government/publications/uk-marine-policy-statement>.
- Howson, C., L. Steel, M. Carruthers, and K. Gillham. 2012. Identification of Priority Marine Features in Scottish territorial waters. Scottish Natural Heritage Commissioned Report No. 388.
- Jentoft, S., T. C. van Son, and M. Bjorkan. 2007. Marine Protected Areas: A Governance System Analysis. *Human Ecology* 35:611–622.
- Jones, P. J. 2012. Marine protected areas in the UK: challenges in combining top-down and bottom-up approaches to governance. *Environmental Conservation* 39:248–258.
- Jones, P. J. S., and a. Carpenter. 2009. Crossing the divide: The challenges of designing an ecologically coherent and representative network of MPAs for the UK. *Marine Policy*

33:737–743.

- Jonsson, P. R., M. Nilsson Jacobi, and P.-O. Moksnes. 2016. How to select networks of marine protected areas for multiple species with different dispersal strategies. *Diversity and Distributions* 22:161–173.
- Kelleher, G. 1999. *Guidelines for Marine Protected Areas*. Gland, Switzerland and Cambridge, UK.
- Laffoley, D., S. Brockington, and P. Gilliland. 2006. Developing the concepts of good environmental status and marine ecosystem objectives: some important considerations. English Nature Research Reports, No. 689.
- Lieberknecht, L., T. Hooper, T. Mullier, A. Murphy, M. Neilly, H. Carr, R. Haines, S. Lewin, and E. Hughes. 2011. *Finding Sanctuary Final Report and Recommendations*.
- Lieberknecht, L. M., W. Qiu, and P. J. S. Jones. 2013. Celtic Sea Case Study Governance Analysis. Finding Sanctuary and England's Marine Conservation Zone process. Summary and Recommendations. MESMA Work Package 6.
- Long, R. 2011. The Marine Strategy Framework Directive : A new European approach to the regulation of the marine environment , marine natural resources and marine ecological services. *Journal of Energy and Natural Resources Law* 29:1–44.
- Magris, R. A., R. L. Pressey, R. Weeks, and N. C. Ban. 2014. Integrating connectivity and climate change into marine conservation planning. *Biological Conservation* 170:207–221.
- Marine Scotland. 2012. *Marine Protected Areas- Frequently Asked Questions*. Available from <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/faqs>.
- McLeod, E., and R. Salm. 2008. Designing marine protected area networks to address the impacts of climate change. *Frontiers in Ecology and ...* 7:362–370.
- McLeod, E., R. Salm, A. Green, and J. Almany. 2009. Designing marine protected area networks to address the impacts of climate change. *Frontiers in Ecology and the Environment* 7:362–370.
- Mee, L. D., R. L. Jefferson, D. d'A. Laffoley, and M. Elliott. 2008. How good is good? Human values and Europe's proposed Marine Strategy Directive. *Marine Pollution Bulletin* 56:187–204.
- Metcalfe, K., T. Roberts, R. J. Smith, and S. R. Harrop. 2013. Marine conservation science and governance in North–West Europe: Conservation planning and international law and policy. *Marine Policy* 39:289–295.
- Mulholland, S. 2014. *Planning Scotland's Seas: Possible Nature Conservation Marine*

Protected Areas. Addendum to Main Report.

- Mulholland, S., and S. Granville. 2014. Planning Scotland's Seas: Possible Nature Conservation Marine Protected Areas Analysis of Consultation Responses. Available from <http://www.gov.scot/Resource/0044/00448890.pdf>.
- Myers, N., and R. Mittermeier. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403:853–858.
- O'Leary, B. C., M. Winther-Janson, J. M. Bainbridge, J. Aitken, J. P. Hawkins, and C. M. Roberts. 2016. Effective Coverage Targets for Ocean Protection. *Conservation Letters*:1–19.
- Olds, A. D., K. A. Pitt, P. S. Maxwell, and R. M. Connolly. 2012. Synergistic effects of reserves and connectivity on ecological resilience. *Journal of Applied Ecology* 49:1195–1203.
- Osmond, M., S. Airame, M. Caldwell, and J. Day. 2010. Lessons for marine conservation planning: A comparison of three marine protected area planning processes. *Ocean & Coastal Management* 53:41–51.
- OSPAR. 2007. Background document to support the assessment of whether the OSPAR Network of Marine Protected Areas is ecologically coherent OSPAR Commission.
- OSPAR Commission. 2003. OSPAR Recommendation 2003/3 on a Network of Marine Protected Areas.
- OSPAR Commission. 2006. Guidance on developing an ecologically coherent network of OSPAR Marine Protected Areas.
- Peel, D., and M. G. Lloyd. 2009. A Coastal and Marine National Park for Scotland: A Tactical or Strategic Affair? *International Planning Studies* 14:293–309.
- Pollnac, R., P. Christie, J. E. Cinner, T. Dalton, T. M. Daw, G. E. Forrester, N. a J. Graham, and T. R. McClanahan. 2010. Marine reserves as linked social-ecological systems. *Proceedings of the National Academy of Sciences of the United States of America* 107:18262–5.
- Reed, M. S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation* 141:2417–2431.
- Salomon, M., and M. Dross. 2013. Challenges in cross-sectoral marine protection in Europe. *Marine Policy* 42:142–149.
- De Santo, E. M. 2016. Assessing public “participation” in environmental decision-making: Lessons learned from the UK Marine Conservation Zone (MCZ) site selection process. *Marine Policy* 64:91–101.
- De Santo, E. M., and P. J. S. Jones. 2007. Offshore marine conservation policies in the North

East Atlantic: Emerging tensions and opportunities. *Marine Policy* 31:336–347.

Scottish Environment LINK. 2013. Response to Planning Scotland's Seas Consultation.

Available from:

<http://www.scotlink.org/files/policy/ConsultationResponses/LINKMPAResponseNov2013.pdf>.

Scottish Government. 2008. Sustainable Seas for all: a consultation on Scotland's first marine bill. Available from

<http://www.scotland.gov.uk/Publications/2008/07/11100221/0>.

Scottish Government. 2010. Making the most of Scotland's seas: turning our marine vision into a reality. Available from

<http://www.scotland.gov.uk/Publications/2010/04/01085908/0>.

Scottish Government. 2011a. A Strategy for Marine Nature Conservation in Scotland's Seas.

Available from <http://www.scotland.gov.uk/Topics/marine/marine-environment/Conservationstrategy/marineconstrategy>.

Scottish Government. 2011b. Marine Protected Areas in Scotland's Seas: Guidelines on the selection of MPAs and the development of the MPA network. Available from

<http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/mpaguidelines>.

Scottish Government. 2012b. Report to the Scottish Parliament on Progress to Identify a Scottish Network of Marine Protected Areas. Available from

<http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/MPAParliamentReport>.

Scottish Government. 2012c. Scottish MPA Project Stakeholder Workshop 5 Summary Report. Available from <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/engagement/270612>.

Scottish Government. 2012a. Scottish MPA Project Stakeholder Workshop 4 - Summary report. Available from <http://www.scotland.gov.uk/Topics/marine/marine-environment/mpanetwork/engagement/WorkshopReports>.

Scottish Government. 2013a. Planning Scotland's Seas Nature Conservation Marine Protected Areas: Draft Management Handbook.

<http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/handbook>.

Scottish Government. 2013b. Planning Scotland's Seas: 2013 Possible Nature Conservation Marine Protected Areas Consultation Overview. Available from

<http://www.gov.scot/Publications/2013/07/2072>.

Scottish Government. 2013c. Planning Scotland's Seas: Consultation on Priority Marine

- Features. Available from <http://www.gov.scot/Resource/0042/00428389.pdf>.
- Scottish Government. 2015a. Scotland's National Marine Plan. Available from www.gov.scot/Resource/0047/00475466.pdf.
- Scottish Government. 2015b. Network Design Queries. [Online] Available at: <http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/engagement/Networkdesign>. [Accessed 17 August 15].
- Scottish Natural Heritage. 2010. Priority Marine Features in Scottish territorial waters External peer review feedback. Available from <http://www.snh.gov.uk/docs/B1150960.pdf>.
- Scottish Natural Heritage. 2012. Advice to the Scottish Government on the selection of Nature Conservation Marine Protected Areas (MPAs) for the development of the Scottish MPA network. Commissioned report 547. Available from http://www.snh.org.uk/pdfs/publications/commissioned_reports.
- Singleton, R. L., and C. M. Roberts. 2014. The contribution of very large marine protected areas to marine conservation: Giant leaps or smoke and mirrors? *Marine pollution bulletin* 87:7–10.
- Trouwborst, A. 2011. Conserving European biodiversity in a changing climate: The Bern convention, the European Union Birds and Habitats directives and the adaptation of nature to climate change. *Review of European Community and International Environmental Law* 20:62–77.
- United Nations General Assembly. 2015. Resolution adopted by the General Assembly on 25 September 2015.
- Voyer, M., W. Gladstone, and H. Goodall. 2012. Methods of social assessment in Marine Protected Area planning: Is public participation enough? *Marine Policy* 36:432–439.

Figure 1. A map of the 30 new Scottish Nature Conservation MPAs designated July 2014.

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