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Review and evaluation of marine spatial planning in the Shetland Islands

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ABSTRACT

Marine spatial planning (MSP) is a fast evolving discipline signified by the European Commission's proposed directive to create a common framework for MSP and integrated coastal management in EU waters and coastal areas. The Shetland Islands' Marine Spatial Plan (SMSP) first developed in 2006 is one of the most advanced in the UK. With seven years' experience of MSP and integrated coastal zone management (ICZM) in Shetland's waters, and the pending statutory implementation of the SMSP in 2014, Shetland represents an exemplar case study for the monitoring and evaluation of this discipline in practice. A review was carried out in 2012 to evaluate and monitor the effectiveness of the SMSP to date. This exercise highlighted achievements to date, future challenges and opportunities and helped to guide the development of the forthcoming edition of the SMSP. The sharing of knowledge and practical experiences of MSP and ICZM ensures an adaptive approach in addressing uncertainty over time. It is also imperative to understand that early 'pioneers' in this discipline may not get it exactly right on the first attempt but by developing initial precedents and processes, these can be built upon in the future.

1. Introduction

MSP is recognised as an important tool in the sustainable management of marine ecosystems [1–6]. Within the EU MSP is being steered by a number of policy drivers including the EU Integrated Maritime Policy [7], Blue Growth [8], Water Framework Directive [9], Marine Strategy Framework Directive [10], Habitats Directive [11], Common Fisheries Policy,[3] Renewable Energy Directive [12] and the recently proposed directive to establish a framework for maritime spatial planning and integrated coastal management [13].

Marine spatial planning in the UK is currently being implemented under the Marine and Coastal Access Act, 2009, Marine (Scotland) Act, 2010 and Marine Act (Northern Ireland) 2013. As momentum gathers for a co-ordinated approach to MSP across Member States, it is prudent to reflect on pilot projects, case studies and past experiences where possible and use this knowledge to monitor and better inform new and emerging MSP initiatives around the world. This encourages collective learning and the dissemination of good practice [14]. Adaptive management will provide a basis for evolution of the concept and practice of MSP. With seven years' experience of MSP in the Shetland Islands, a review of the Shetland Marine Spatial Plan (SMSP) carried out in 2012 is a timely account of 'learning by doing'.

2. The Shetland Islands' Marine Spatial Plan

The SMSP commenced in 2006 under the auspices of the Scottish Sustainable Marine Environment Initiative (SSMEI), which was established by the Scottish Government via Marine Scotland and guided by a national and local steering group. The overarching aim of SSMEI was to develop and test the effectiveness of differing management approaches to deliver sustainable development in Scotland's coastal and marine environment [15]. As well as Shetland, three other pilot study areas selected: Firth of Clyde, the Sound of Mull and the Berwickshire coast. Shetland however,

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[3] The Common Fisheries Policy is currently undergoing reform. On 13 July 2011, the European Commission presented its proposals for the reform of the EU common fisheries policy and, on 2 December 2011, it proposed a new fund for the EU's maritime and fisheries policies for the period 2014–2020: the European maritime and fisheries fund (EMFF). More information available at: European Commission's Fisheries Reform website.

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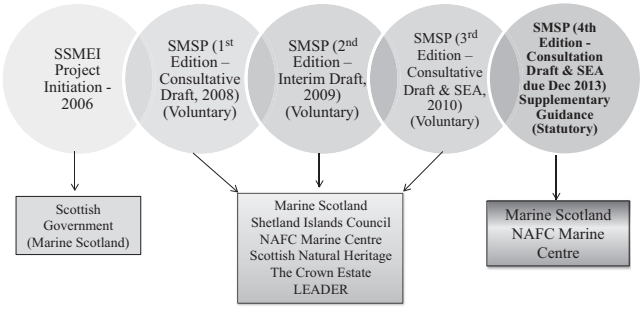

Fig. 1. Key stages in the development of the SMSP (2006-present), illustrating the adoption of editions on a voluntary or statutory basis. Funders for each edition are also shown.

is at the most advanced stage of all of the four pilot areas with the pending publication of the fourth iteration of the SMSP, Fig. 1. The SMSP has been constructive in helping the Scottish Government to develop a national planning framework for Scotland [16].

Whilst funding for the SSMEI project ended in 2010, the SMSP with support from the Scottish Government through Marine Scotland, continues to be developed as part of the core work of the NAFC Marine Centre, Shetland Islands. The Marine Spatial Planning team at the NAFC Marine Centre engage regularly with key stakeholders, supported by a Local Advisory Group. The Local Advisory Group comprises decision-makers, regulators, non-Governmental Organisations (NGOs), local industry and community representatives. Currently there are 21 active members representing the Shetland Islands Council (planning, coastal zone management, natural heritage, ports and harbours, elective representatives); NAFC Marine Centre marine spatial planning section staff; Marine Science (compliance); Shetland Community Councils; Scottish Environmental Protection Agency (SEPA); Scottish Natural Heritage (SNH); Fair Isle Marine Environment & Tourism Initiative (FIMETI); Shetland Amenity Trust (Biological Records & Archaeology); Royal Society for the Protection of Birds (RSPB); and marine industries including oil and gas, aquaculture, fishing (shellfish and finfish) and renewable energy.

The SMSP provides a policy framework and baseline spatial data to guide the placement of marine developments. The policies and spatial data encompass socio-economic, cultural and environmental uses and features. The SMSP was voluntarily adopted by the local advisory group in 2008, including the Shetland Islands Council, government agencies (SNH, SEPA) and industry representatives; and since then has been consulted when assessing marine developments.

Shetland Islands Council intends to adopt the SMSP on a statutory basis as 'Supplementary Guidance' to its Local Development Plan in 2014. Shetland Islands Council is in a unique position to adopt a marine spatial plan due to the consenting power afforded to it under the Zetland County Council Act 1974, as amended, (the ZCC Act).

Following the emergence of the oil industry in Shetland in the 1960s new powers were conferred on the Shetland Islands Council under the ZCC Act, whereby the Shetland Islands Council has a duty to promote the conservancy of, and control of development in, the coastal area of Shetland, with the exception of those areas under the jurisdiction of Lerwick Port Authority or Broonies Taing Pier Trust.[4] In this context, the placing of any works as defined by the ZCC Act, in the sea, on the seabed or on the foreshore below Mean High Water Springs (MHWS) and out to 12 nautical miles will require consent in the form of a works licence from the Shetland Islands Council. 'Works' means developments of all types, excluding those for the purposes of marine fish farming which requires a separate consent from the Shetland Islands Council under the Town and Country Planning (Scotland) Act 1997 (as amended).

Fig. 2. Location map of the Shetland Islands. The spatial extent of Shetland Islands' Marine Spatial Plan area is shaded in grey representing the 12 nautical mile limit from Mean High Water Spring. Contains UKHO data © Crown copyright and/or database rights. © NAFC Marine Centre.

Whilst all councils in Scotland have produced plans to manage the placement of marine aquaculture developments, the unique consenting powers under the ZCC Act gives the Shetland Islands Council an opportunity to test a holistic local policy framework to guide the placement of all development within marine waters around the Shetland coast through the development of the SMSP.

The policies and maps in the SMSP will be material considerations in decision-making on individual marine planning applications and works licences within Shetland's coastal and marine waters out to 12 nautical miles (NM) as illustrated in Fig. 2. The SMSP aims to streamline the development application process by enabling developers to identify suitable areas for development and potential constraints at the feasibility and pre-application stage. This should lead to a reduction of conflicts and provide greater certainty for long term investment decisions by decreasing commercial risk and remaining regulatory burden [17].

3. Review methodology

The review of the SMSP was carried out in 2012 by the Marine Spatial Planning team based at the NAFC Marine Centre to help

[4] Zetland County Council Act, 1974.

them guide the development of the fourth edition of the SMSP to be adopted as Supplementary Guidance in 2014. This was an exercise of 'learning by doing': the review represents an informal evaluation which forms part of a feedback loop system in progressing MSP in Shetland.

The review of the SMSP involved a qualitative and quantitative assessment of stakeholder involvement, usability of the SMSP and marine licensing and permitting procedures. This was based on a collection of baseline data from reports, research and literature reviews, interviews, direct observations and sample questionnaires.

A number of questionnaires were distributed to local stakeholders requesting feedback on the SMSP and its accompanying atlas of maps (the Atlas). For example, marine industry representatives/developers were asked specific questions: when and how the SMSP was used i.e. at site selection, pre-application consultation, application and EIA stages; rating the ease of use of the policies and data (scale of 1–5); effectiveness of the SMSP; information or data to be included in the next edition; if the SMSP helped to speed up the application process; and if they had experience of using other marine spatial plans and data and how the SMSP compared. Other stakeholders questioned included regulators, consultees and decision-makers who were asked similarly tailored questions on usability and referencing of policies and data, effectiveness of the policies etc.

Achieving social, environmental and economic objectives can be measured against a range of indicators. However, as the SMSP has been progressing within an evolving legislative framework in Scotland, it is too early to reach and measure environmental and socio-economic outcomes. It was therefore considered more pertinent to look at the performance of the SMSP to date rather than assessing the 'state of the environment' [18].

The outcomes of the review provided a valuable synopsis of how the plan has progressed.

4. Key themes of the review

As part of the review, a number of recurring topics emerged and are summarised under key themes.

4.1. Provision of comprehensive data and information

4.1.1. Users of the SMSP

All respondents to the questionnaires highlighted how useful the Atlas has been in providing important guidance and spatial context at a local level. For example, as aquaculture is quite a mature industry in Shetland one of its representatives felt that the Atlas would be of highest value for companies new to Shetland. This was echoed in responses from the marine renewables and dredging industries where it was felt that both the policies and Atlas were easy to use and had assisted at feasibility, scoping and pre-consultation stages. In particular, it was noted that the baseline information contained within the SMSP had been used to consider environmental restrictions/key sensitivities; cultural and heritage interests; and industry/built infrastructure parameters and exclusion areas. Responses from industry also confirmed that the SMSP would be referenced in supporting documentation going forward for planning permission/work licenses and will help to assess potential conflicts with other marine activities.

It was also noted that the SMSP had provided new information that developers were unaware of and would have led them to expend considerably more resources in accessing and collating the information from elsewhere or could have inadvertently led to conflict. One renewable energy representative stated that the SMSP made Shetland 'a more attractive place to come'. This is a clear indication of how the SMSP has been of significant help in attracting developers and investment to Shetland. Incorporating renewable energy development and specific policies in the SMSP adds certainty to the sector and facilitates its long-term investment [2].

From an industry perspective it is evident that the SMSP is proving to be helpful in the consideration and location of marine developments, in particular, during the initial planning stages. There is continuous demand for the data to be kept up-to-date and where further data becomes available it will be published within the SMSP and reviewed every 6 months.

Usage of the plan and Atlas has also been monitored by keeping a record of registrations for data requests which commenced in August 2010. Since then there has been a total of 47 requests for data downloads from the NAFC Marine Centre website. The requests were from a number of organisations including the public sector, research institutes, charities, individuals and the majority from industry. The plan and Atlas was also sent to approximately 200 developers, stakeholders and regulators at the launch of previous editions of the plan.

4.1.2. Marine planning and licensing

Shetland Islands Council's Coastal Zone Manager confirmed that both the SMSP policies and maps are consulted for all marine development proposals, with the latter providing spatial context and information on other marine users. A review of permitted marine-related planning applications and works licences noted that the SMSP had been referenced in 46% of the marine planning documents reviewed for 2009. While this figure decreased steadily in the subsequent years (10% in 2011) the Coastal Zone Manager indicated that this should not be interpreted as a decline in its use; it may be an indication that planners and developers are more familiar with the SMSP and as such have no need to make reference to it continuously. In discussion with Scottish Natural Heritage (SNH), it was noted that quantitative figures on the use of the SMSP are also not entirely representative because some officers may only refer to it in cases of conflict (i.e. to give weight to an objection).

Since the review was carried out in 2012, a further check of sample marine planning reports noted an increase to 88% of those referencing the SMSP in the period for 2013. This increase in use may in part reflect the increase in profile of the plan generated by the review and by the development of the fourth edition.

The review indicated that the development of the SMSP has helped developers gain a deeper understanding of the ecosystem services currently being provided by the marine environment, helping them to site or plan their development to reduce user–user and user-environment conflict. The review also indicated that regulators are using the plan to assess applications and to address conflict. This indicates that MSP can lead to better management of the marine environment.

4.2. Identifying development opportunities

Defining and analysing future conditions for ocean space is an integral step in the MSP process [3]. In the SSMEI National Review it was recognised that there may be some reluctance to defining strict zones for different activities [15]. However, it was stated that without any clear spatial guidance on which activities might be able to co-exist in which areas, MSP is unlikely to achieve its stated aim of 'giving direction' or 'streamlining the development application process' for developers and regulators. It was suggested that zones could be used to define areas by their character, existing uses and suitability for different activities, within which more specific policies can apply.

In the development of the SMSP, it is acknowledged that some industry representatives were not in favour of zoning of sea uses/activities. One local aquaculture company representative asked that the plan identified development opportunities whilst one of the renewable energy developers considered it best to avoid setting 'hard' zones for the development of renewable energy. Given that the industry is fast evolving, developers felt that there are many parameters to be considered including the actual capacity/size of array development, type of technology, energy climate and extraction performance etc. Some previous efforts at zoning development areas seem to have been based on somewhat arbitrary or directly challengeable assumptions (e.g. cut off set on available energy climate or overall farm capacity). Therefore developers were of the opinion that as their understanding of the technologies improves with maturity/commercialisation then re-assessment of factors such as potential interactions and optimal siting is expected. A cumulative approach that maintains the ability to re-analyse the localisation of energy renewables with 'fuzzy' zones or preferred areas without excluding any but the most restricted or sensitive sites is the favoured option.

It was therefore concluded that the information contained within the Atlas, highlighting existing uses and therefore potential conflict was sufficient for most users. Specific locational guidance has since been published as part of the SMSP to help guide renewable energy development in Shetland's marine waters, see Section 5.3.

4.3. Economic benefits from conservation measures

A regulating order (RO) is a piece of legislation granted by Scottish Ministers under the terms of the Sea Fisheries (Shellfish) Act 1967 to encourage the sustainable maintenance and management of the shellfish fishery. The Shetland Islands Regulated Fishery Order (regulating order) grants the Shetland Shellfish Management Organisation (SSMO) the legal right to manage commercial shellfish fisheries within the area between the low water mark and the six mile limit around Shetland. In addition, the regulating order gives the SSMO powers to impose restrictions and regulations, to issue licences, and to impose fees. In Scotland national policy is progressing towards a similar de-centralised, stakeholder-driven management of inshore fisheries [19]. Currently the establishment of Inshore Fisheries Groups is being implemented throughout the rest of Scotland whose remit is to improve the management of Scotland's inshore fisheries out to 6 nautical miles with the exception of Shetland which has its own management arrangements. Given this unique management arrangement, the SMSP team were able to work with the SSMO to encourage the sustainable management of the local shellfish fishery by identifying seabed habitats that could be negatively impacted by shellfish fishing.

The SSMO devised management measures which included shellfisheries closures to protect important seabed habitats such as maerl, horse mussel beds and eel grass. The closures were voluntary in the first instance but were subsequently made statutory (by Scottish Government) at the behest of industry.

The development of these measures assisted the Shetland inshore fleet gaining Marine Stewardship Council (MSC) accreditation for three shellfish stocks (king scallops, brown and velvet crabs). This is an example of how the local Shetland inshore fishing industry has endorsed conservation measures to gain potential market advantage.

The data held within the SMSP relating to these habitats was of varying quality with some of the data over 30 years old. Some of the data were therefore considered by the industry to be poor, dated or contested as no longer true (horse mussel beds in particular are known to collapse and diminish). The fleets agreed to adhere to the available data in the SMSP as a precautionary approach after the NAFC Marine Centre pledged to re-map the areas in detail using its side-scan sonar equipment. The survey carried out in 2011 provided an opportunity to refine the existing marine spatial plan data to better reflect the distribution of seabed habitats. The findings of the study indicated that while the initial areas defined were not accurate, they did provide an initial starting point from which further refinements could be made [19]. These closed areas have been reviewed and updated accordingly in the fourth edition of the SMSP.

As a result of the MSC accreditation, the seafood industry is assured that the shellfish stocks come from a well-managed and sustainable source. This may have important ecological and economic impacts for the local inshore fishery [20].

4.4. Addressing cumulative impacts

A recurring issue raised during the review process has been the need to address cumulative impacts. Although a number of pilot studies and the pre-consultation draft National Marine Plan included a matrix of interactions (user–user conflicts) and/or matrix of sensitivities (user-environment conflicts) [21,22], this provides only an initial simplified view of the likely level of interactions between a range of marine uses. The SSMEI National Review report [15] highlighted that the process of identifying interactions both between different uses/activities and the marine environment had been very effectively carried out by several of the pilot projects.

These interactions matrices only represent an initial step in assessing cumulative impacts. It would be more relevant to test a more 'spatial' approach and identify locations where multiple pressures are acting on an existing use or feature and where specific policies are required to resolve interactions.

4.5. Leadership

Several pilots in the SSMEI National Review commented on a difficulty in steering groups reaching consensus; pending selection of Scottish Marine Regions this may continue to be a challenge. It was felt that without a lead body to make a final judgement, there is a risk that policies become very high-level and general as detail and direction is sacrificed in order to ensure everyone is accommodated. It is important that consensus is reached and the plan is acceptable to everyone but individual policies need to be precise, targeted and enforceable.

In 2012 the governance structure for the SMSP was revised and expanded in the form of a local advisory group. The day-to-day management of the plan is led by the NAFC Marine Centre with support from the local advisory group.

Experience from other pilot regions suggests that simply 'grafting' MSP onto existing governance structures may appeal in terms of administrative and related efficiencies but may also serve to frustrate efforts to implement the ecosystem approach, due to a mainly sectoral management tradition from before as was evidence in the Clyde [23]. Existing governance structures may have a history of conflict with some marine stakeholders, which may make other stakeholders reluctant to engage in the process and it may also result in issues of transparency and accountability. These concerns should be given full consideration when deciding whether to create a new administrative agency to lead MSP or to assign the task to an existing set up. It is therefore advised to assess whether any existing institutional arrangement is fit for purpose before assigning it the responsibility of delivering MSP [23].

4.6. Status of the plan

In Scotland another challenge for MSP has been the non-statutory status of the pilot plans to date. This problem was highlighted where existing agencies do not have the authority to hold other government departments or agencies to account, or to compel them to comply with the plan [23]. Similarly, during the review process, developers reported that the SMSP policies were not being fully implemented due to it being adopted on a voluntary basis. As a result there was no incentive for them to adhere to policies included in the SMSP or conversely, to highlight developments that may have been non-compliant with certain policies. This is an important consideration which will be addressed in Shetland when the SMSP is adopted by Shetland Islands Council as Supplementary Guidance to the Local Development Plan in 2014.

Whilst it was suggested that the decrease in reference to the plan in 2011 was due to developers' and planners' increased familiarity with the plans content, feedback from developers that they felt the plan was not being enforced may infer that some proposed developments would have been against the policies within the plan. However, the recent increase in usage of the plan by regulators highlights the benefit of raising the plan's profile and the move towards its statutory implementation. The SMSP has been voluntarily adopted for 5 years (2008–2013) and this timescale is perhaps too long with the transition from voluntary to statutory implementation needing to be more rapid to maintain the plan's momentum. Monitoring of the SMSP policies should also become easier in the future when they are a material consideration in the decision making process for marine developments.

5. Future challenges

Monitoring and evaluation can help to promote understanding and improve planning and decision-making [18,24]. As reflected by Douvere and Ehler [18], how will it be possible to improve subsequent iterations of plans without knowing what is working, or not, in existing marine spatial plans?

An adaptive approach to planning and management is necessary to incorporate various types of change within the marine environment such as environmental change, changes in political priorities, new economic realities, new knowledge and the experience gained from the practice of ecosystem based management in MSP [14,18]. Good monitoring and feedback loops are seen to be effective in keeping all involved in the process informed, on track and able to assess progress and make changes where necessary. Without regular monitoring the plan runs the risk of 'drifting away' from its original vision and strategic objectives [25]. The review therefore has been imperative in highlighting future challenges and key themes to be addressed. The most important of these themes has been the forthcoming statutory adoption of the SMSP which will give weight to the policies and spatial data in the decision making process. This will help to address any uncertainty regarding the plan's status and ensure legal authority and political support for the continuation of MSP in Shetland.

5.1. Ecosystem based approach

The European Commission endorses the ecosystem based approach to integrated MSP and coastal zone management [4]. It is noted however that a poor understanding of this key concept can lead to failed attempts at holistic marine management. Experience has indicated that the place based nature of the ecosystem approach is an essential element in the planning process and if not incorporated appropriately can result in a predominantly sectoral approach to policy formulation [23].

The spatial aspect of planning has been intrinsic to the SMSP as is evidenced in the commended SMSP Atlas. The SMSP Atlas provides a holistic overview of the physical, ecological, cultural and socio-economic characteristics of Shetland's coastal and marine waters and incorporates the place based nature of the many marine activities and uses reliant on this important resource. In the forthcoming edition of the SMSP it was considered important to ensure a cross-sectoral approach to marine planning and as a result, the policy framework has been revised based on integrated themes which align with the UK's national objectives i.e. a clean and safe, healthy and diverse and productive marine environment. Policy development sub-groups were established to discuss the detailed wording of the policies and these were based on the collaborative themes to ensure an integrated holistic approach to policy formulation. To maximise the potential to further integrate the policies and spatial data, it was decided to incorporate the maps into the main text of the plan to ensure place-based policy formulation and management. This is expected to mediate between sectoral interests and promote cross sectoral synergies, ensuring due regard for impacts on other marine uses, as required in the ecosystem approach.

Stakeholder engagement in the MSP process is an important factor in delivering an equitable, integrated and transparent marine plan. A participatory approach to plan preparation will also help to achieve broad acceptance, ownership and support for implementation [2,4,23]. As MSP progresses in Shetland, the membership of the local advisory group has been reviewed and new stakeholders included where required. This is to ensure that as many marine sectors and stakeholders are represented and incorporated in the process as possible, enhancing the quality of the process.

As part of the review it became apparent that as MSP emerges as a new discipline, changes in legislation occur in parallel which have implication on policy areas. It is important therefore to keep abreast of pertinent legislative changes and translate priority areas into policy. This allows policy to reflect real-time and future development scenarios stemming from these drivers of change. In the subsequent editions of the SMSP policies have been introduced to address new legal requirements, future demands and challenges, such as coastal and marine water quality, marine litter, noise, seaweed cultivation and harvesting as well as managing marine protected areas (MPAs), priority marine features and marine geodiversity, all of which are within the remit of the SMSP.

In addition to the aforementioned policy areas, integrating the human dimension into the SMSP was another aspect which was improved upon. This aspect is intrinsic to MSP which relates offshore activities to onshore communities, livelihoods and cultures [1]. The interests of coastal communities require the same attention as the ecological and physical attributes of the marine environment [2]. In response, additional stakeholder consulted data were included in later versions of the SMSP to supplement existing collated data on popular dive sites, sea angling spots, rowing and boating areas such as areas for surfing, windsurfing, climbing, coastal walks and areas of aesthetic value such as wildness areas. By mapping these community activities and assets they become visible, are recognised as having a cultural and spiritual value and play an active role in the MSP process as equal to the marine environmental and economic assets. Improved policies have been included in the SMSP to protect coastal communities from adverse social impacts, to safeguard marine recreation from inappropriate development and to protect the landscape character.

5.2. Spatial data and information

At the start of any MSP process, it is accepted that complete knowledge, data and information are never available [18,25]. At a time when advances in technology are occurring rapidly,

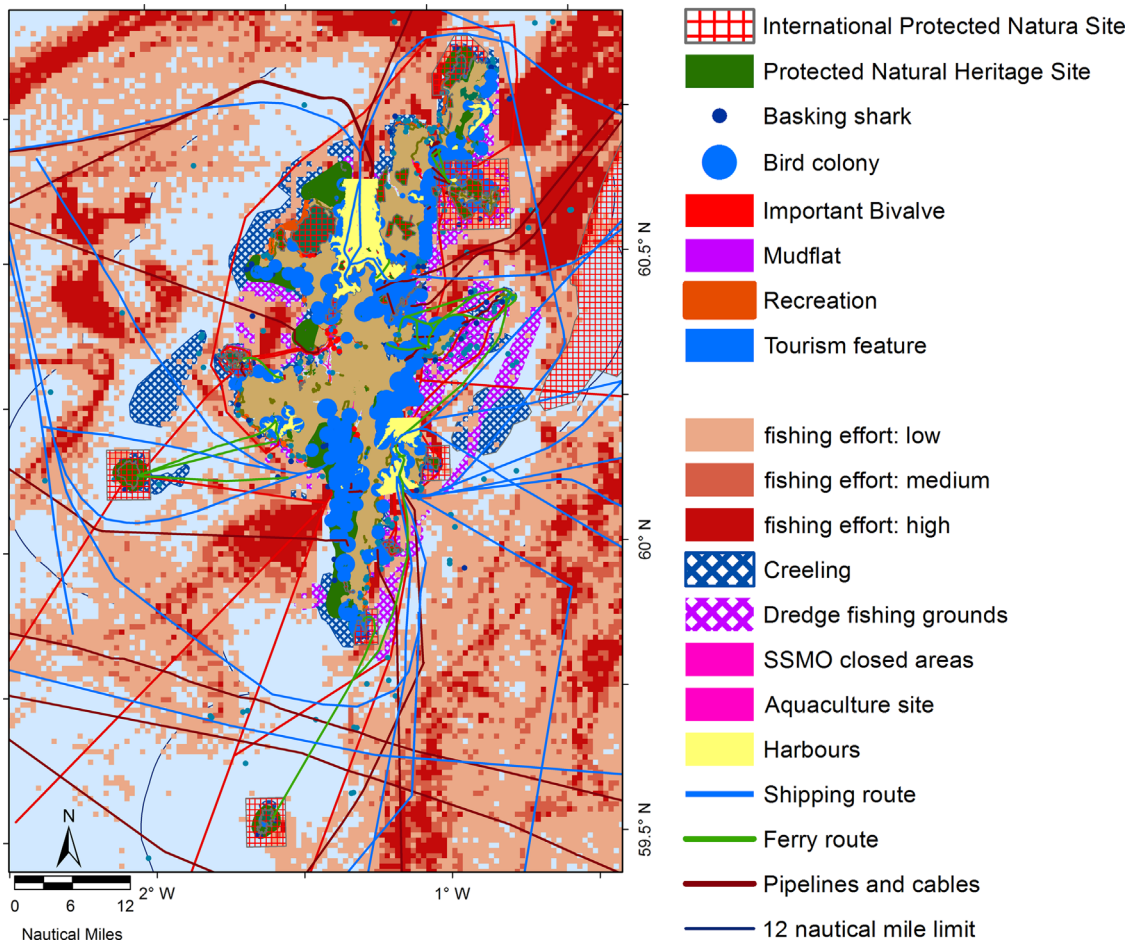

Fig. 3. Spatial overview of marine uses and important marine features within 12 nautical miles of the Shetland coast. Contains Ordnance Survey data © Crown copyright and database right 2011. Contains UKHO data © Crown copyright and/or database rights. © NAFC Marine Centre.

new tools and techniques such as remote sensing and geographic information systems (GIS) are allowing spatial and temporal data to become more accessible [26]. It is important to engage with stakeholders in the collation of data to ensure an element of quality control and assurance [25]. Recognising that new data can be collected in parallel with plan development and incorporated in subsequent plan revisions will allow for a more flexible and relevant approach [6]. One of the SMSP objectives for monitoring and review includes updating the spatial data every 6 months.

One major challenge experienced in Shetland was the use of local datasets versus national datasets. On a number of occasions developers, consultants and government agencies have chosen to use national data instead of the locally consulted data in the SMSP Atlas which incorporates both national and local datasets and a process of local quality assurance. Projects using the national dataset as opposed to locally compiled data risk being data deficient, and may result in inaccurate models and mapping outputs. As a result, these outputs may be misleading to potential developers and are contradictory to the SMSP intentions, which are to ensure and promote 'buy-in' of local data use. This issue of preferring national datasets over locally consulted datasets is a challenge which should be addressed and has the potential to cause future problems where licensing is controlled at the national level.

To allow for a more holistic marine knowledge base it is important to record historical, anecdotal and predictive data. The ability to predict ecosystem behaviour is currently limited and knowledge on states, processes and outcomes relating to ecosystem impacts is, and will continue to be, very uncertain [2]. Therefore it is imperative that relevant and appropriate data, both historical and current, are collected and collated on a regular basis; this is a lengthy and continuous process. By 2013 the update of the maps in the fourth edition of the SMSP had incorporated 127 datasets from 60 separate sources in a process that took four months. An overview of data incorporated in the SMSP on marine uses is included in Fig. 3.

Another challenge for data collation and management is commercial sensitivity and ownership of personal data. An example of this was the recent inclusion of VMS[5] data for local whitefish boats around Shetland in the SMSP. Whitefish fishing grounds were historically mapped in the SMSP Atlas based on anecdotal evidence (i.e. hand drawn polygons in consultation with only a small sample of local fisherman). More recently these maps were not considered to be accurate enough or a true reflection of important whitefish fishing grounds therefore, access to local fishermen's VMS data were made available by individual vessel owners, co-ordinated through the Shetland Fishermen's Association (SFA).

Based on the local permissions granted, Marine Scotland provided the raw VMS to the SMSP team, which was then aggregated in GIS to provide an overview of fishing intensity. This aggregation of data ensures anonymity of individual fishermen and their fishing grounds. Whilst the data have been made available to the SMSP the data ownership resides with the

[5] Vessel monitoring system (VMS).

fishermen, and the process of quality control amalgamation and granulation has been guided by the fishermen.

One could argue that it is one aspect of the MSP process to collect the data; it is another to use the data effectively. It is recommended that a distinction should be made between intensely used and sparsely used areas and to concentrate MSP efforts on the former [4]. In the new edition of the SMSP where data allows, some of the datasets have been visualised as intensity maps. Intensity maps allow easier visualisation of large datasets and they can also be used to increase the granulation of sensitive or incomplete datasets, for example otter holts where it is not permitted to show individual holt locations. It is important to realise that data are just one decision support tool which assists with spatial and decision analysis. Other support tools such as stakeholder engagement, education, best practice models, method or skill-based licensing, permitting and economic instruments are also required [27].

5.3. Development opportunities

In accordance with European guidance, the management of maritime spaces through MSP should be based on the type of planned or existing activities and their impact on the environment [4]. In Europe, driving factors such as demands for marine renewable energy were perhaps the catalyst for identifying opportunities for development in recent times [28]. In the North Sea, for example, the Dutch government in developing their Integrated Management Plan for the North Sea included opportunity maps for sea uses such as offshore wind farms, mineral extraction and conservation [29]. These are similar sea uses/ growth areas identified within the Belgium Marine Spatial Plan [30]. Both MSP areas are supportive of co-locating shellfish farming with offshore wind farms therefore promoting different activities within the same zone at the same time, at different depths. Therefore incorporating multi-use objectives or zoning and supporting regulations for future development are options worth considering as key management measures in the development of any marine spatial plan.

The use of zoning as a management measure has been successfully applied in Australia [27,31]. Some consider it a primary mechanism used to implement decisions along with issuing leases and permits for activities in these areas [6].

Zoning can provide many benefits in marine management including highlighting areas of ecological importance or vulnerability, allowing co-location and/or synergies between activities, minimising conflict between incompatible uses and maximising the achievement of social, economic, and ecological objectives [24]. Elsewhere, zoning is faced with some opposition. In the US it is considered a political non-starter where it is perceived as government intrusion in people's lives [24]. However when MSP involves mapping of optimal areas for different ocean uses (i.e. zoning) this can provide clear economic and policy-streamlining benefits even in the US [24].

In the SMSP, zoning per se has not been endorsed. Instead, a more sensitivity led approach to identifying suitable areas for development has been employed. The recently published Regional Locational Guidance for Wave and Tidal Devices in the Shetland Islands (RLG) is a first step in identifying opportunities for future development [32]. This mapping exercise was undertaken by the SMSP team to develop local guidance for wave and tidal devices, and cable landing points around Shetland. Maps showing potential areas of constraint were created through a process of consultation with local advisors, planners, regulators, communities and developers. They are designed as a support tool to make more informed decisions about where developments are likely to be successful and where they are likely to encounter conflict. This exercise was the preferred option over arbitrary zoning in agreement with local stakeholders. The findings of the assessment are part of an on-going process which will be updated as new information becomes available.

5.4. Economic benefits from conservation measures—Importance of stakeholder engagement in adaptive management

In Shetland, fisheries closures for priority marine habitats may result in potential economic benefits for the local fisheries industry as well as ensuring ecological benefits. This example of implementation of fisheries policies within the SMSP demonstrates an iterative, stakeholder-driven approach that may be relevant for other areas. The approach is particularly applicable in the absence of full survey data or the means to conduct the same, which will be the situation at the beginning of most MSP processes. The potential for economic and ecological gains however make this adaptive approach worthwhile for all stakeholders involved. It also allows for the more efficient and rational use of marine space to provide a balanced view between competing uses [17].

5.5. Cumulative impacts

A sensitivity matrix was included in the earlier editions of the SMSP and was a first step in determining potential impacts between human activities and important species and habitats around Shetland. The next logical step was to address cumulative impacts, interactions and capacity of marine resources to accommodate future sustainable development. Current work being carried out as part of the SMSP is using GIS to map cumulative pressure areas around Shetland based on an ecosystem-based risk assessment (ERA). This location specific method is a move away from the generic, single sector analysis approach of the interactions matrix, and is deemed more relevant and sympathetic to local factors.

As consultation on the cumulative impacts exercise is on-going with local experts and stakeholders in Shetland, there are opportunities to adapt and improve on the methodology and data used. It is hoped that this exercise will promote discussion and debate among stakeholders and subsequently help to advise and formulate future policy in the SMSP.

6. Key lessons learned

As part of any review and evaluation exercise, it is important to reflect on areas for improvement as well as the achievements. If undertaking a monitoring and evaluation exercise again, what would the SMSP team do differently? As stated already, the SMSP was developed during a period of evolving MSP legislation and without the availability of good practice guidelines or step-by-step approaches to plan making [3]. Therefore with the benefit of more advice and guidance, the use of plan targets and indicators are now regarded as key measurements in MSP monitoring and evaluation.

It is now acknowledged that both quantitative and qualitative indicators are important tools in evaluating progress. These include performance measures as well as ecological and environmental metrics. As discussed in Section 3, as part of the review methodology it was considered more pertinent at the time to look at the 'performance of the SMSP' rather than assessing the 'state of the environment', where conditions of the marine environment are recorded and monitored for improvements or deterioration. For example, assessing improvements in water quality status, as it takes time to achieve measurable environmental and socio-economic outcomes.

Whilst the review indicated that MSP can help to achieve ecosystem based management and is valued by developers and regulators, the use of 'SMART' objectives and indicators (i.e. specific, measurable, achievable, realistic and timely) in future SMSP monitoring will be crucial in determining achievements. Previously proposed objectives and indicators were not realistic or achievable because the SMSP team did not have access to all the data needed nor the resources to pursue it as it was implemented on a voluntary basis. This highlights the difficulty of voluntarily adopted plans and the need for a legislative framework to support MSP.

As more data and information are collected as part of the on-going development of the SMSP a benchmark can be created against which future change to both the condition and uses of the marine area and the design and functioning of the governance system can be assessed. This will help decision-makers determine whether they are likely to achieve objectives. An update of the Strategic Environmental Assessment (SEA) has been carried out as part of the development of the fourth edition of the SMSP which includes a set of more specific and tangible objectives and indicators than the previous edition which are supplemented by performance measures outlined in the monitoring and review section of the SMSP. These performance measures include recording the time it takes authorities to determine marine applications and the number of objections submitted against applications. This will help to determine if the SMSP is streamlining the development process and helping to reduce conflicts.

7. Conclusion

With 7 years' experience of MSP in Shetland, it is important to communicate the lessons learned so that other countries or regions embarking on similar exercises for the first time can avoid unnecessary pitfalls and emulate successes. While one size does not fit all in MSP, experimentation, innovation, monitoring, learning and change are all aspects of the process that plan-makers and decision-makers can collectively learn from and share experiences in. Plans should therefore be designed for feedback and adaptive learning which links monitoring with future plan revisions.

A number of pertinent points have been highlighted as part of the review and as part of the discussion on future challenges and lessons learned. One of the main issues is the decision to zone or not to zone. From the Shetland experience, 'traditional' zoning has not been endorsed. Initial feedback from stakeholders was that where there is an already reasonable level of marine development, zoning was not considered the best approach. Instead, a more sensitivity led approach to identifying suitable areas for development has been employed. However in less developed areas, a different approach to zoning may be an appropriate management measure. Conventional zoning is sometimes perceived as incapable of representing the three dimensional aspect of the marine environment in comparison to terrestrial spatial planning. However; it is possible to have different activities happening at the same time at different depths in the same zone, as is already implemented in Australia and the North Sea (27, 29, 30, 31).

In terms of the status of a marine spatial plan, the review revealed that when the SMSP was adopted on a voluntary basis, developers were less inclined to adhere to the policies of the plan as they were not being fully implemented. By adopting the SMSP as a statutory instrument, the plan's policies must be taken into account by regulators and decision-makers i.e. as a material consideration in all marine development applications and licences. The statutory adoption of any marine spatial plan is intrinsic to its full and successful implementation.

The governance structure in Shetland is unique to the rest of Scotland. Given the Shetland Islands Council's powers to manage development within its coastal waters under the ZCC Act, the statutory adoption of the SMSP has been more critical in providing a framework for planning and decision making in the seas around Shetland. Adoption of the SMSP as Supplementary Guidance ensures that the terrestrial and marine planning processes are fully aligned, and ICZM can be achieved in Shetland.

The collection and collation of data has been a key step in the MSP process. Throughout the development of the SMSP, both historical and current data were collected on a regular basis which proved to be a lengthy and continuous process. Another challenge for data collation and management is commercial sensitivity and ownership of personal data. It is important to have a protocol put in place such as aggregating data to provide a spatial overview of marine usage and, at the same time, ensuring anonymity of individual's usage. Similarly, where data allows, some datasets can be visualised as intensity maps which allows users to view large datasets more easily. It is important to realise however that data is just one decision support tool which assists with spatial and decision analysis. Other support tools such as stakeholder engagement, best practice models etc. are also required.

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