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Viewpoint

Using best expert judgement to harmonise marine environmental status assessment and maritime spatial planning

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ABSTRACT

All maritime states have the challenge of maintaining the environmental quality of their seas while at the same time maximising their economic potential thus requiring appropriate science, governance and management measures. In Europe, directives and regulations are used to address the pressures affecting the health and sustainability of marine resources, and to promote Good Environmental Status (GES) (e.g. the Marine Strategy Framework Directive, MSFD), while having a coherent and integrated pattern of sea use (e.g. the Maritime Spatial Planning Directive, MSPD). Therefore, an approach is required to meet these challenges for all maritime states including, for Europe, the joint adoption of these two directives. As such an approach does not yet exist, one is proposed here based on a hypothetical example and a Best Expert Judgement (BEJ) methodology. Forty-two marine science, management and impact assessment specialists provided views on a hypothetical marine scenario to derive and interrogate a framework applicable to marine areas with multiple uses and users. The scenario allowed the severity of the activity effects-footprints to be determined on the 11 MSFD Descriptors of GES with that severity being weighted according to the area of each activity effect-footprint. In turn, this allowed the calculation of marine regional environmental status thereby indicating whether the adoption of quality assessment and spatial planning can be mutually beneficial, or are antagonistic in meeting environmental targets. This paper uses the proposed approach to discuss maximising the assimilative capacity of a marine area and minimising the environmental degradation due to new activities. It especially shows the role of BEJ in cases where marine adaptive management is still required despite their being an often paucity of information or data on which to base management decisions.

1. Introduction

Marine management should maintain and protect ecological structure and functioning while at the same time allow the system to produce ecosystem services from which societal goods and benefits are derived (Elliott et al., 2017). The marine space is a complex mosaic of activities, each with their own set of effects-footprints and where overlapping effects-footprints can produce cumulative impacts (Ban et al., 2010; Halpern et al., 2015; Korpinen and Andersen, 2016). Whilst these activities have the potential to reduce the environmental quality of a marine area, proactive marine management through spatial planning and licensing is needed to determine where those activities should be permitted and what is their overall impact. Those permissions are required to enable the wise use of the marine environment and thus maximise Blue Growth (European Commission, 2012) while at the same time ensuring that the health of the marine environment is not compromised (Tett et al., 2013). Because of this, the greatest challenge in marine management is in deciding where activities are permitted (i.e. Maritime Spatial Planning) bearing in mind the relative effects (footprints) of combined activities (i.e. marine environmental status assessment) (herein termed “effects-footprints”). This challenge applies to all marine areas worldwide but especially those territorial waters that support many activities. The analysis presented here uses the European management framework as an example but emphasises that the lessons are transferrable to the adaptive management of all developed marine areas.

Historically, the adaptive management of maritime activities has encompassed separate sectoral policies that were often reactive in nature, e.g. the European Urban Waste-water Treatment Directive (91/271/EEC), aimed at ensuring the level of treatment to land-based sewage discharges reflects the ability of a body of water to assimilate those effluents. This sectoral approach has led to a piecemeal application to protecting the marine environment, and it is only in the last 15 years that EU law has changed to a holistic system approach created

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by the evolution of EU directives (Borja et al., 2010; Boyes et al., 2016). This is mirrored in the US through its Clean Water Act. Policy mapping undertaken by Boyes and Elliott (2014) shows the complexity and large volume of environmental legislation used to manage activities and pressures in the marine environment.

The Marine Strategy Framework Directive (MSFD; 2008/56/EC) (regarded as the *instrument for marine environmental quality*) has a vision 'to promote sustainable use of the seas and conserve marine ecosystems'. This uses a common framework that aims to achieve Good Environmental Status (GES) in the marine environment by 2020 (Borja et al., 2013). The concept of environmental status accommodates the structure, function and processes of the marine ecosystems together with natural physiographic, geographic and climatic factors, as well as physical and chemical conditions, including those resulting from human activities in the area concerned. Achieving GES will be shown through indicators of 11 Descriptors (e.g. biodiversity, commercial fish, eutrophication, seafloor integrity, etc.), some of which relate to pressures, others to status and the reminder relating to the functioning of the system. As a result, marine environmental managers are faced with a set of challenges when permitting and locating activities in marine areas (Box 1).

There are many EU directives for environmental protection but, given the large number of marine activities competing for space (e.g. Boyes et al., 2007), there is now the need for European and national governance mechanisms which allow apportioning or managing of the marine space, thus becoming analogous to planning laws on land. The most comprehensive and recent example is the Maritime Spatial Planning Directive (MSPD, 2014/89/EU; regarded as *the instrument for marine blue growth*); this establishes a framework for maritime spatial planning, requiring that marine plans must be produced by all European maritime states by March 2021. The introduction to the MSPD states that '*…maritime spatial planning should apply an ecosystem based approach…with the aim of ensuring that the collective pressure of all activities is kept within levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems to respond to human-induced changes is not compromised….*'. However, the Directive appears to promote policies contrary to this philosophy, by supporting Blue Growth in the marine environment despite growing indications that the target for GES by 2020 is unlikely to be met (Jones et al., 2016). Competition for maritime space has highlighted the need for effective and adaptive management, to avoid potential conflicts whilst creating synergies between different activities.

The maritime spatial planning (MSP) process can be either proactive (deciding where activities are allowed) or reactive (deciding what space is unoccupied and thus available for an activity) by those responsible for managing a sea area (i.e. the regulators, the competent authorities in governance). The MSP can be achieved either by a detailed, formal decision-making system or on a case-by-case basis depending on the existing activities. It must encompass a system where each individual activity, depending on its size, is subject to an Environmental Impact Assessment (EIA) but where all combined activities are subject to a Strategic Environmental Assessment (SEA). Planning decisions should be made in consultation with the developer, the regulator and stakeholders concerned; a requirement that inevitably gives rise to challenges in deciding the location of a new activity (Box 1).

All marine activities could affect the environmental quality for GES for each MSFD Descriptor in the area where the activities take place. Strong (2016) shows that the extent of impacts, and thus the requests for the possible derogation of GES, created by marine activities or pressures, can be assessed and mapped using: 1) the physical footprint which is the immediate area on which an activity causes as impact, and 2) the near-field footprint in the area surrounding the anthropogenic pressure but which is not directly associated with the physical footprint of the activity or pressure. Some activities will also have a far-field effect, for example, seabed mining where disturbed fine material is carried by prevailing currents and deposited away from the site of the activity. However, although there are holistic assessments which assume the plethora of human activities will cause impacts (Halpern et al., 2008; Borja et al., 2016), there are few, if any, which have measured the actual footprints of all existing activities in an actual area.

Following the above, it is necessary to determine whether approaches to achieve GES (as exemplified by the MSFD) or to satisfy MSP (as exemplified by the MSPD) can be mutually beneficial to the protection of the marine environment, or whether they directly compete with one another and potentially present barriers to meeting environmental targets. Given the urgent need to achieve this joint aim, and recognising that there may be a paucity of data in many of the geographic areas in which the directives must be applied, this paper proposes and uses an approach based on Best Expert Judgement (BEJ). The approach has been developed using a hypothetical area on the basis that, if it is adopted, the approach can subsequently be tested on an actual area.

Box 1
What are the challenges for marine environmental quality assessment and maritime spatial planning?

For existing activities:	For new activities:
• What activities are there, how many and what is their duration and frequency? • What area do they occupy? • Is there a monitoring programme for each activity? • What are the near- and far-field footprints of the pressure(s) they give rise to? • Which of the activities overlap? • What proportion of the area to be managed is occupied by those footprints? • What is the effect of the cumulative footprints on the area environmental status and quality? • Have the existing activities exceeded the assimilative capacity of the area? • Have the existing activities reduced the natural carrying capacity of the area? • Can the assimilative and carrying capacities be determined? • What is the influence on the occupied and unoccupied space from external influences such as climate change?	Should a new activity be located: • Where the developer wants it to be? • Where the regulator wants it to be? • Where all the stakeholders want it to be? • Where the conditions are suitable for it? • Where there is available space for it? • Where it is compatible with existing activities? *or* • Where the assimilative capacity of the system can accommodate it? • Can the change in the assimilative and carrying capacities be predicted if new activities are permitted? *and* • If the capacity cannot accommodate it, will the environmental regulator say it cannot be allowed *despite* prevailing economic drivers or other imperative reasons of overriding public interest (IROPI)?

2. Methodology

2.1. Empirical best expert judgement approach

Determining and managing the effects of human activities requires a risk assessment and risk management approach (Cormier et al., 2013) in which decision-making often occurs in the absence of information (or even the presence of poor information) and so increasingly requires expert judgement (Rosqvist, 2003). BEJ involves providing experts and decision-makers with a structured framework to help identify optimal decisions (Weisberg et al., 2008; Burgman et al., 2011); those decisions may be based on modelling or on a consensus reached between a group of managers, stakeholders or single bodies responsible for making defendable decisions. EU framework directives use the ecosystem approach to inform management decisions and, from that, management effectiveness has to be judged. Therefore the approach proposed here determines the value of BEJ as a valuable tool within marine