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The effectiveness of the mitigation hierarchy in environmental impact studies on marine ecosystems: A case study in France

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ABSTRACT

While the development of maritime economic activity is increasingly encouraged, the consideration of its impacts constitutes a real challenge. The limitations of the implementation of the mitigation hierarchy have been widely discussed in scientific literature, yet data on marine biodiversity offset practices remains scarce. In this study, we investigated the use of Environmental Impact Assessments (EIAs) as suitable instruments to achieve the No Net Loss objective. Drawing on a French approach developed for the initial assessment of the European Marine Strategy Framework Directive, we examined the pressures and impacts related to various marine development projects and the effectiveness of the mitigation hierarchy in limiting these. An analysis of 55 recent French environmental impact studies showed that only 7% of the proposed measures had the aim of offsetting predicted degradation of sites of remarkable biodiversity. This can be partly explained by the lack of a clear definition of 'significant impact', which varies greatly depending on what is impacted, in turn allowing socio-economic activities to benefit more easily from offset. Furthermore, offsetting does not always constitute the final step of the mitigation hierarchy, highlighting the need to reinforce avoidance and reduction steps. Although we acknowledge the role of EIA in mitigating the negative impacts of development projects, synergies with other European marine environmental policies such as the Marine Strategy Framework Directive (MSFD) and the Maritime Spatial Planning directive (MSP) should be developed in order to improve current practices.

1. Introduction

One of the most common tools used worldwide in the implementation of the mitigation hierarchy (the avoidance, reduction and offset of environmental impacts of authorized development projects), is Environmental Impact Assessment (EIA). As a result, the role of EIA as a suitable instrument to reach the objective of 'No Net Loss'[1] has drawn much attention (Jiricka and Pröbstl, 2009; Villarroya and Puig, 2010). Nevertheless, the focus has mainly been on terrestrial applications. At a time when numerous governments are encouraging the development of economic activity within the marine realm following broader calls for 'Blue Growth' (European Commission, COM (2014) 254/2), one might ask to what extent we have the capacity to tackle the impact of this activity. Recently, France extended its Exclusive Economic Zone (which was already the world's second largest, after that of the United States) by 500,000 km^2 through the claim of rights over the continental shelf beyond the traditional 200 nautical miles (United Nations Convention on the Law of the Sea, 1982). This extension concerns mainly Martinique, Guadeloupe, French Guiana, New Caledonia and Kerguelen Islands. Of the 11 million km^2 of sea zones under French jurisdiction, 97% concerns its overseas territories. This makes France the only country with sea zones around four continents, including a wide range of marine ecosystems. Thus French waters display a particularly rich marine biodiversity which makes France an interesting case study for marine offset implementation.

Currently, scientific literature on marine biodiversity offset practices is scarce, focusing either on highly productive and valuable coastal ecosystems, such as mangrove swamps, coral reefs or seagrass environments (Bos et al., 2014; Levrel et al., 2012), or on a particular sector, such as the context of offshore wind farms in Europe (Vaissière et al., 2014). The aim of this study was to investigate the implementation of the mitigation hierarchy in the specific context of authorized marine and coastal development projects. Rather than using a silo-based approach traditionally employed in ocean and coastal management (Mengerink et al., 2009), we drew on a French approach implemented within the framework of the initial assessment of the European Marine

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[1] The objective of this principle, first introduced in the United States to preserve wetlands, is to ensure that the impacts on biodiversity caused by a project are balanced or outweighed by measures taken to avoid or minimize the project's impacts, to undertake on-site restoration, and, finally, to offset the residual impacts, so that no loss results (Business and Biodiversity Offsets Programme, BBOP, 2012).

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Strategy Framework Directive (MSFD – EC, 2008) to examine the pressures and impacts related to various marine development projects and the effectiveness of the mitigation hierarchy in limiting these.

We analyzed why in 55 recent (2003–2015) French environmental impact studies, in which 556 impacts were identified, only 7% of the proposed measures were aimed at offsetting predicted degradation. The studied reports mainly deal with sediment dredging and disposal, port infrastructure, and water withdrawal and discharge. Various marine ecosystems, located in the Mediterranean, the Atlantic, the English Channel and the Caribbean, are potentially impacted by these projects. Using the data available in the impact assessments studies, we investigated the pressures generated by the projects and their impacts, both on the biological sphere and on socio-economic activities. We then assessed the proposed measures in the mitigation hierarchy and how they correspond to the described impacts, giving special attention to the offset phase. The paper identifies the current challenges in the implementation of the mitigation hierarchy in the marine realm and suggests several ways forward.

Section 2 describes the methodology used for the analysis, which was based on MSFD 'Good environmental status' descriptors. Section 3 presents the general characteristics of the environmental impact assessments studied. Section 4 details pressures, impacts and their related mitigation measures displayed in the impact studies and Section 5 describes the mitigation measures' content. Section 6 discusses the current shortcomings in mitigation hierarchy implementation. Finally, Section 7 concludes and put forward some recommendations.

2. Methodology

This study is based on the analysis of 55 environmental impact studies[2] linked to marine and coastal development projects in mainland France and its overseas, carried out in the context of European environmental regulations. Despite France's stated commitment as a signatory to the Aarhus Convention which guarantees "the right of access to environmental information held by or for public authorities" (EC, 2003) and the creation of a national data archive of Environmental Impact Assessments (EIAs), it is currently difficult to access these studies. As a result, the reports we analyzed included studies that were available from French environmental consultancies in 2015 (the studies could date from 2015 or before). Whether or not a project benefited from a regulatory approval was not taken into account in the selection of the impact assessments studied since to the best of our knowledge, some are still pending and the rare withdrawals were only due to economic reasons and not to a lack of compliance with environmental requirements. This study is based on the assumption that a thorough analysis must take both ecological elements and socio-economic use into account.

To analyze the impacts on the marine environment caused by development projects and the measures proposed to mitigate these, we drew on the French approach used for the MSFD. In this, the initial assessment of the ecological state of marine waters and the environmental impact of human activities on these waters is based on indicators showing pressures[3] and impacts. Following the opinion of several environmental impact analysts, we added some further categories to allow a more thorough description of the biological medium and socio-economic activities. We then used this homogenous typology (Table 1) to carry out a quantitative assessment of pressures and impacts on habitats, species and socio-economic uses.

In each study we analyzed, the impacts were considered to be the product of the intersection between the pressure generating the impact and the impacted element. For each 'pressure/species–habitat–socio-economic activity' pair for which an impact is described in an environmental impact study, we noted:

- The intensity of the impact after avoidance and reduction measures, i.e. the 'residual impact', in line with the mitigation hierarchy definition (1 – low impact, 2 – moderate impact, 3 – high impact, −1 – positive impact). The score reflects the assessment displayed in the impact study, but is standardized according to the described scale.
- If one or several avoidance, reduction, offset, monitoring or accompanying measure(s)[4] has/have been proposed (different types of measures may be proposed for one impact).

In our analysis, offset measures could be applied to either ecological elements or socio-economic activities, but could not overlap. A measure had to be designed either to compensate for an ecological impact or for an impact on a human activity – a single measure could not address both.

We thus obtained a database for all 55 environmental impact studies, describing the given impacts (−1, 1, 2, 3 or 0 if no impact) and proposed measure(s) (1 if present or 0 if absent) (Table 2).

3. General characteristics of the analyzed studies

We then analyzed these 55 environmental impact studies related to actual development projects (i.e. not plans or programmatic studies). Although the sample of studies was selected for their availability, we believe they are a relevant representation of current impact studies in the marine realm. The studies encompass a wide range of development projects, on different coastlines, potentially impacting numerous marine ecosystems, and subject to several regulatory frameworks.

3.1. Types of development projects

Most of the marine development projects in the impact studies dealt with four types of activity: sediment dredging (24%), disposal of dredged material (19%), port infrastructure (19%), and water withdrawal and discharge (17%) (Fig. 1). The graph below illustrates the diversity of engineering works carried out in marine environments. These activities can occur concurrently within one project (for instance, a port extension project can involve construction of port infrastructure as well as dredging and sediment disposal).

3.2. Regulatory procedures in which the mitigation hierarchy is applied

Historically, French legislation began to formally take the environment into account relatively early. In 1976, the Nature Protection Law was passed, requiring the implementation of the mitigation hierarchy, in which a project must first avoid, then reduce environmental impacts, and finally, if needed, define offset measures for residual, unavoidable and uncontrollable impacts defined as 'significant'. Since then, this law has been reinforced and supplemented several times, particularly by a

[2] We use the term 'environmental impact studies' as the analyzed studies correspond to different regulatory procedures (see Section 2 for their description) and not only to Environmental Impact Assessments (EIAs) in the strict sense of the term.

[3] This approach uses a framework to show the interaction between the environment and socio-economic activities: DPSIR → Driving forces – Pressures – States – Impacts – Responses (European Environment Agency).

[4] Offset actions could be direct actions on an environment (e.g. ecological engineering) or management actions to reduce human pressure on an environment (Business and Biodiversity Offsets Programme, BBOP, 2012). Monitoring measures correspond to observation of environmental components and/or socio-economic activities that could be potentially impacted by the development projects. The so-called accompanying measures (as mentioned in MEDDE, 2013) can consist of knowledge acquisition, the definition of a broader conservation strategy, the implementation of a biotope protection order overseen by the national or local government, etc. They can be designed to improve the effectiveness of offset measures or to additionally safeguard their environmental success. They can also target socio-economic activities.