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An Italian proposal on the monitoring of underwater noise: Relationship between the EU Marine Strategy Framework Directive (MSFD) and marine spatial planning directive (MSP)

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ABSTRACT

In recent years, many studies have evaluated the effects of anthropogenic acoustic disturbance on marine organisms. Sounds associated with shipping, seismic surveys, sonar, and many other such sources induce several types of effect on fish and marine mammals. In this regard, the European Marine Strategy Framework Directive 2008/56/EC has not only defined underwater acoustic noise as "the intentional or accidental introduction of acoustic energy in the water column from impulsive and diffuse sources", but has also expressly identified it as a form of pollution.

In 2014, the first Italian proposal has been defined with the aim of developing a widespread monitoring plan for sub-regions in European Union waters with respect to two different sub-programs concerning impulsive (Descriptor 11.1) and continuous low frequency (Descriptor 11.2) sounds. The objective of Marine Strategy Framework Directive is the implementation of a recording system for temporal-spatial data regarding impulsive sound sources arising from anthropogenic activities. The pressure, for Descriptor 11.1, is measured by evaluating the source level, or a suitable proxy for anthropogenic sound sources, measured over the frequency band 10 Hz–10 kHz (and up to 40 kHz for cetacean detection), that could have an impact on marine organisms.

The Descriptor 11.2 would monitor trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1 μPa RMS; average noise level in these octave bands over a year) via observation stations. This monitoring plan aims to obtain noise maps of sea regions for the frequency band 10 Hz–10 kHz (and up to 40 kHz for cetacean detection) by improving existing geophysical/acoustic observation stations, e.g. those of the National Institute of Geophysics and Volcanology (INGV) and the National Institute of Nuclear Physics (INFN), as well as other medium- and long-term monitoring stations. The program also wants to define the level of damage caused by underwater noise, using underwater noise as an example to evaluate the impact of this type of noise on different marine organisms.

Maritime spatial planning (MSP) and integrated coastal management (ICZM) have to employ an ecosystem-based approach that ensures the protection of the natural resources and provides the basis for carrying out the various monitoring activities. The Italian monitoring proposal on Descriptor 11 of Marine Strategy Framework Directive (MSFD) was used in order to analyze the strategic vision of the integrated maritime policy (IMP) between MSFD and MSP programs in terms of achieving Good Environmental Status (GES).

1. Introduction

1.1. Introduction: an overview of European marine strategies and marine spatial planning

The marine environment plays a fundamental role in the climatic balance, and is a valuable and important source of economic

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resources, social well-being and quality of life (Hoegh-Guldberg and Bruno, 2010). Today, the anthropogenic pressures on marine and coastal environments are increasing (Salomon, 2009; Abdulla, 2008). Three instruments with which to empower the governance of these European marine and coastal zones have been employed: the Integrated Maritime Policy (IMP),[1] the Marine Strategy Framework Directive[2] (MSFD) and the Maritime Spatial Planning Directive (MSP).[3] The MSFD and MSP had a common origin but, over the years, they were affected by the ordinary legislations evolution summarized in the following short running timeline; this can help to give an overall view on the complex picture that affect the maritime coastal policy:

- Starting phase: was adopted in EU resolution on the protection of coastal areas[4] (Huggett, 1998) – (1970s).
- The European parliament adopted a resolution on developing European coastal charter that underscore the need for integrated planning for coastal areas[5] – (1980s).
- The European Union (EU) has been developing frameworks and plans with a view to achieving a good status of coastal zones, seas and their resources (Breen et al., 2012) – (1990s).
- The European Parliament and Council adopted a Recommendation concerning the implementation of Integrated Coastal Zone Management in Europe[6] – (2002).
- EU IMP – Integrated Maritime Policy – to consolidate coastal and marine data[7] – (2002).
- EU adopts MSFD – Marine Strategy Framework Directive – to monitor sea ecosystems and recovery by 2020[8] – (2008).
- EU Commission establishes criteria for GES – Good Environmental Status – of marine waters and includes 11 Descriptors of good status by 2020[9] – (2010).
- European Parliament and Council adopted legislation to create a common "framework for maritime spatial planning in Europe[10]" – (2014).

Regarding the criteria adopted for GES, among the 11 Descriptors of GES, the Descriptor 11th states that the "introduction of energy (including underwater noise) does not adversely affect the ecosystem". The introduction of energy such as light, electricity, heat, noise, electromagnetic radiation, radio waves or vibrations into the sea changes physical systems (Van der Graaf et al., 2012). Currently, in relation to assessment and monitoring, the measurement of underwater noise, including underwater noise pollution mapping (Tasker et al., 2010), has been identified as a priority (subject to further developments). Anthropogenic sounds may be short- (e.g. impulsive forms such as seismic surveys, piling for wind farms and platforms, and explosions) or long-lasting (e.g. continuous in the form of dredging, shipping and energy installations), and affect organisms in different ways (Filiciotto et al., 2013, 2014; Kight and Swaddle, 2011; Tyack, 2008; Engås et al., 1996). Most commercial activities entail high noise levels that affect relatively broad areas and are executed under regulated conditions subject to a licence (Popper and Hawkins, 2012). This creates an opportunity to coordinate coherent requirements for measuring loud, impulsive sounds. Sound effects can be separated into chronic noise (continuous sounds), such as that related to shipping traffic, or event noise (impulsive noise like that is caused by pile driving or seismic surveys).

As contemplated in the MSP, this legislative instrument should indirectly apply the ecosystem-based approach, as referred to in Article 1(3) of Directive 2008/56/EC, with the aim being to ensure that the collective pressure of all activities is kept within levels that are compatible with the achievement of GES (Douvere, 2008). The precedent's assumptions clearly emphasize the fact that the monitoring of indicators of GES in both the MSFD and MSP is a key factor when it comes to assessing the effectiveness of the programs and achieving the anticipated objectives on a regional and local scale (Cinnirella et al., 2014).

It is important to stress that both MSFD and MSP require a regional cooperation through and coordination of activities between Member States (MS) and, whenever possible, Third Countries sharing the same marine region or subregion. Clearly, these cooperation activities are strictly linked to the several priority that each MS adopt in its marine waters, sharing the operation management of threats and risk of the region or sub-region. In the southern of Mediterranean a crucial role will be played by third countries that should participate proactively to achievement of GES of the MSFD in the neighboring marine sub-regions (Douvere et al., 2007). These activities of coordination are supported by the EU Directorate-General Environment and Affair Maritimes and Fisheries promoting the regional cooperation structures as the Regional Seas Convention (RSC), and in particular for Mediterranean area by the Barcelona Convention of 1992. This could represent impartial frameworks in Inter-Mediterranean dialog on maritime themes.

In this paper, we examined the current status and future effectiveness of the Italian monitoring plan for Descriptor 11- the introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment (Directive 2008/56/EC Annex I) through the assessment of intensity, spatial-temporal extension of sound pressures, and vulnerability of marine ecosystems – in order to analyse the strategic vision of the MSFD and MSP when it comes to achieving GES.

1.2. Underwater sounds: an overview

Sound is a dominant feature of the underwater marine environment as a result of natural and human-made sound sources (Merchant et al., 2015; Popper and Hastings, 2009; Richardson et al., 1995). The term 'sound' is refers to acoustic energy, transmitted as a longitudinal wave that is radiated from a mechanical vibration, with no particular reference to its function or potential effects. Sounds include both meaningful signals and 'noise', which may have either no particular impact or a range of adverse effects. The term noise is only used where adverse effects are specifically described (Hildebrand, 2005), or when referring to specific technical distinctions such as 'masking noise' and 'ambient noise' (Clark et al., 2009; Slabbekoorn et al., 2010; Tasker et al., 2010).

[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – An Integrated Maritime Policy for the European Union COM (2007) 574 final.

[2] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy.

[3] Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning.

[4] Council of Europe Committee of Ministers. Resolution (73) 29 on the protection of coastal areas.

[5] Resolution of the European Parliament (OJ C 182, 19.7.1982, p.124–126).

[6] EU Recommendation 2002/413/EC of the European Parliament and the Council of 30 May 2002 concerning the implementation of integrated coastal zone management, OJ L 148, 6.6.2002, p. 24–27.

[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – An Integrated Maritime Policy for the European Union COM(2007) 574 final.

[8] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy.

[9] Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (2010/477/EU).

[10] Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning.