"UNDERSTANDING THE LEGAL DEVELOPMENT AND CHALLENGES REGARDING UNDERWATER NOISE POLLUTION IN SPAIN AND NORWAY"

"COMPRENDIENDO EL DESARROLLO JURÍDICO Y RETOS DE LA CONTAMINACIÓN ACÚSTICA SUBACUÁTICA EN ESPAÑA Y NORUEGA"

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Abstract: Noise is one of most important pollution that affects to human health, but in aquatic ecosystem its impact is higher than terrestrial. Noise is included in environmental acts only by sectorial mechanism but, in 2010, this vision changed. Ecosystem approach was incorporated in Spanish acts with first legal instrument for protecting from holistic perspective internal seas. From the European Union built news regulations about marine policies from ecosystem approach, with two essentials acts, Maritime Spatial Planning and Marine Strategies. In this paper, we analyse these mechanisms in Spain and Norway; we make a descriptive research about the legal mechanism for managing the underwater noise pollution generates by human activities. And we compare different mechanism to use with priority in these countries and we try to answer that if it is necessary to incorporate another instrument, such as an underwater noise licence, for any anthropogenic activity with to noise limits.

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Resumen: El ruido es una de los contaminantes más importantes que afecta la salud humana, pero en el ecosistema acuático su impacto es mayor que el terrestre. El ruido se incluyó en la normativa ambiental mediante instrumentos sectoriales, pero, en 2010, esta visión cambió. El enfoque ecosistémico se incorporó en el sistema de protección ambiental español con la primera normativa en tener en cuenta una perspectiva holística de protección del medio marino. Desde la Unión Europea, se elaboraron nuevas regulaciones sobre políticas marinas desde este enfoque ecosistémico, con dos mecanismos esenciales, la Planificación Marítima Espacial y las Estrategias Marinas. En este artículo, analizamos estos mecanismos en España y Noruega; Realizamos una investigación descriptiva sobre el mecanismo jurídico para gestionar la contaminación acústica subacuática generada por las actividades humanas. Y comparamos diferentes mecanismos que se utilizan en estos países e intentamos responder si es necesario incorporar otros instrumentos, como pueden ser licencias o valores límite.

Keywords: Underwater noise pollution. Marine Strategies. Maritime Spatial Planning. Ecosystem approach.

Palabras clave: Contaminación acústica subacuática. Estrategias Marinas. Planificación Espacial Marítima. Enfoque ecosistémico.

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1. INTRODUCTION

Various activities have been converging within the marine environment for centuries, but for just a few decades, the anthropic factor has increasingly pressed natural resources. In this complex mosaic of activities that are being developed, it has been observed how the human factor leaves a mark that is not simply limited to a direct impact on nature. The effects derived from human pressure can accumulate in such a way that it can generate a massive loss[2] of existing biodiversity (Elliott, et al. 2018). The effects and consequences of human actions have gone largely unnoticed until recently, and thanks to the advancement of science, most recent research reveals that anthropic activities have increased harmful effects on the environment (Papanicolopulu, 2011). This happens in any activity that generates pollution of some kind and, in addition, the effects and consequences are worse when it happens within the marine environment (Ortiz García, 2011); it has taken a long time to protect the marine environment.

Implementing efficient marine management mechanisms, proactive in nature, that incorporate instruments such as spatial planning, is necessary to increase efficiency. However, it is not enough. A previous analysis is needed of the activity where the impacts it has on the environment in general, and the marine environment in particular, are analysed. Different multidisciplinary aspects must be analysed, which may be harmful to nature, in order to allow a rational use of marine resources and ensure the good condition of our seas and oceans (European Commission, 2012). A source to negative impacts is marine noise which is the theme for this paper.

Marine underwater noise is one of the environmental pollutants that the different species that live on the planet face today. Anthropic activity has not stopped and this type of pollution affects all species (Lindgren & Wilewska-Bien, 2016). Different anthropic activities generate numerous changes in seas and oceans[3], due - in part - to a lack of precise knowledge about the consequences thereof. However, the pressure level increases in such a way that it has intensified the effects of noise within the marine environment (Andrew, Howe, Mercer, & Dzieciuch, 2002). Scientific results are increasingly advancing,

[2] Some researchers indicate that we are facing the sixth mass extinction of species (Ceballos, et al., 2015). The difference with the previous events is that the action of the human being is behind this extinction. The acceleration in the disappearance of some species is a consequence of the loss of habitats, overexploitation of species, pollution or climate change, but in all of them, the human being is present.

[3] Seas and oceans are not ecosystems where silence prevails, we must bear in mind that it is a medium where the interactions between many species require sound and this "noisy" environment has always existed, it is what we can consider to be ambient sound (Stanley & Jeffs, 2016).

but there is still a long way to go (Papanicolopulu, 2011). The increase in underwater noise in aquatic ecosystems causes a series of highly complex ecosystem changes.

Until just a few years ago, scientific research focused on marine mammal species[4], which are at the top of the trophic chain of aquatic ecosystems (Erbe, 2011). The advance of science and the discovery of the effects have spawned rigorous studies that demonstrate the damage that noise causes to other species[5], such as fish and invertebrates (Hawkins & Popper, 2016).

Underwater noise has a greater impact than the perceived environmental noise outside this medium. Water facilitates its propagation (due to the characteristics it exhibits), enabling the emission to reach much greater distances, with the damages that it can cause. The characteristics of noise allow us to differentiate between impulse or continuous noise[6]. Impulse noise is associated with short periods of emission, which can be recurrent and intermittent, whilst continuous noise can last for a long period of time. In both impulse and continuous noise, there are different types of frequency, a characteristic common to both.

[4] They use sound actively and passively to communicate, cover a wide range of frequencies, from a few Hz to more than 100 kHz, which makes these species unique in the use of sound. Studies have been conducted for quite some time, however, since the 1970s, a decade in which the first regulatory measures for the protection of these species were implemented (Erbe, Dunlop, & Dolman, 2018), the number has increased significantly.

[5] The introduction of noise into the marine environment increases stress throughout the marine ecosystem (Wright, et al., 2007). The effects not only affect marine mammals, underwater noise causes physiological, hormonal and behavioural changes in other species. Rako-Gospie & Picciulin (2019) detect significant variations in some biological parameters in crustaceans, caused by the noise of ships. Another of the effects is hormonal variations due to exposure to ship noises that increase the metabolism of some species, affecting the survival and growth thereof (Wale, Simpson, & Radford, 2013). In summary, underwater noise at certain frequencies generates damage and risk to marine fauna; it affects fish (Buscaino, et al., 2016) (Wysocki, Dittami, & Ladich, 2006), molluscs (Aguilar de Soto, et al., 2013), crustaceans (Celi, et al., 2014) and marine mammals (Aguilar de Soto & Kight, 2016) (Sivle, et al., 2012). The direct impact caused by noise in seas and oceans generates variations in the physiology of some species and, in addition, in the behaviour of some species (Rako-Gospie & Picciulin, 2019) (Popper & Hawkins, 2014) (Popper & Hawkins, 2012).

[6] Impulse noise can be low, medium or high frequency, usually associated with construction or building projects using certain machines that generate this type of sound (Hildebrand, 2009) (OSPAR, 2009). Continuous noise can be low frequency and propagate over a long distance. It affects a large swathe of an ecosystem and ships and energy installations emit this type of sound: they generate a constant noise that can accumulate and cause harmful effects on marine species (Popper & Hastings, 2009).

The classification of sound by frequencies or by impulses is important because of the damage it can cause. Sources of emission are varied. One of the best known for their effects are sonars[7], or air guns, which emit impulsive high frequency noises, affecting certain species and generating, among others things, effects on behaviour. Noise linked to maritime traffic affects different species (Rako-Gospie & Picciulin, 2019); the problem remains the lack of existing knowledge about the effects and consequences of accumulated prolonged exposure to this type of pollutant. One of the priorities is to establish limits and ranges for underwater noise, and this is something that some countries are currently working on. This step is necessary to analyse an environmental authorisation that can be granted for activities that generate noise with impacts on ecosystems. In some species transit areas, such as the cetacean corridor, it is urgent due to the scale of the impacts upon species (Rako-Gospie & Picciulin, 2019).

Public administrations and institutions have to set up a common regulatory framework to protect ecosystems. There can be no differences between territories; it is not possible to implement regulations within the area of a given country if there is another bordering country with a different set of regulations for this matter. Due to the increase in human activities on the seas, oceans and the coast (Salomon, 2009), the existing legal regulatory framework focuses on the ecosystem approach. Seas and oceans require a multiplex, integrated and holistic protection system due to the complexity of their elements. The main instruments of protection are the Integrated Maritime Policy (IMP), the Marine Strategy Directive (MSD) and the Maritime Spatial Planning Directive (MSPD). There are others, of sectorial scope, that serve to increase the efficiency and effectiveness of the established protection (Macarrone, Filiciotto, de Vicenzi, Mazzola, & Buscaino, 2015).

Norway has extensive experience in maritime planning and management. Between 2007 and 2009[8], a management mechanism based on an ecosystem perspective was established, with the model implemented in the Barents Sea plan[9]. Norwegian maritime planning systems follow global strategies that cover all economic sectors for their management based on mechanisms where

[7]The naval industry uses some types of sonars that work at frequencies of between 1 and 4 kHz. They cause accumulative effects on some species of cetaceans. This emission causes direct effects on the behaviour of some whale species, such as *minke* (Kvadsheim, et al., 2017).

[8] See "Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands" in Report nº 8 to the Storting (2005-2006) The Royal Norwegian Ministry of the Environment, where in chapter 6th, discuss about noise and seismeic surveys are primarily of importance in relation to the fisheries sector.

[9] Plan of the marine environment of the Barents Sea was developed from 2002-2006, and approved by the Norwegian Parlament in 2006. See more about this plan in this link-

sustainability is the main axis, as examples, the Nature Management Act of 2009 or the Marine Resources Act[10]. This extensive experience in the development of standards for environmental management and maritime planning from an ecosystem perspective, is the reason why we focus on Norway to compare it with Spain.

In this article, we examine the current implementation status of the ecosystem approach in relation to underwater noise regarding the standards established in Spain and Norway. We study whether it is necessary to increase their effectiveness in such a way that the implementation of a licensing regime would be required prior to the start of an activity[11] that may generate such a level of noise that could impair the normal development of a marine ecosystem.

2. METHODOLOGY

The methodological challenges in this research mainly arise from the intertwinement of various disciplines: law and natural sciences. Marine ecosystems are complex in terms of their configuration and the regulation thereof. Underwater noise pollution is a real and powerful contaminant and its effects accumulate over years. This paper is a comparative analysis between Spanish and Norwegian environmental law regarding underwater noise pollution from the ecosystem approach.

This research follows the methodological framework proposed by Moran (2002) for comparative legal studies but incorporating other aspects of legal doctrine matters (Singhal & Malik, 2012), and this methodology has been used by other legal studies, for example, by Salvador, Gimeno & Sanz-Larruga (2018) and I coincided with them about this approach. This method is convenient for this research because:

1. We identified legal obstacles that have resulted in a lack of development of underwater noise pollution measures in environmental law (Salvador et al., 2018). After some background reading of the environmental law of Norway and Spain, we have selected two legal instruments to analyse the incorporation of the

[10] See "Meld. St. 37 (2012-2013) Report to the Storting- Integrated Management of the Marine Environment of the North Sea and Skagerrak (Management Plan)" explain the importance of underwater noise and its impacts in Norway and internationally.

[11] The United Kingdom, within the marine strategy measures programme, has established a licensing regime for maritime activities that can generate an impact due to the noise produced. For this, they set up a system of limits and ranges that can be harmful to marine ecosystems (HM Government, 2012).

ecosystem approach: the Maritime Spatial Planning Directive[12] (MSPD) and the European Marine Strategy Framework Directive[13] (MSFD). The legal literature has highlighted the key role that the MSPD and the MSFD can play in addressing many of the issues related to underwater pollution (Macarrone, Filiciotto, de Vicenzi, Mazzola, & Buscaino, 2015). However, there is a lack of studies focused specifically on the influence of the Spanish and Norwegian MSPD on the development of underwater noise pollution. Regarding the MSFD, some states have initiated changes to incorporate underwater noise as a relevant pollution, but a strong impulse to elevate the efficiency and effectiveness of this kind of legislation is necessary, hence the main research questions of this paper: is it necessary to incorporate another instrument, such as an underwater noise licence, for any anthropogenic activity? Is it necessary to incorporate underwater noise limits to protect large ecosystems?

2. We conducted a descriptive study of both domestic legal frameworks within the context of the MSPD and the MSFD regarding underwater noise pollution with the ecosystem approach. In this sense, we used the legal doctrinal method, which is classified into two categories: primary research tools (such as European law and Spanish and Norwegian domestic law), and secondary sources, with other materials (legal articles, legal books, etc.) (Salvador et al, 2018).
3. We identified relevant differences and similarities between both legal frameworks, in order to extract the main conclusions, discuss policy implications and provide recommendations (Salvador et al., 2018).

3. UNDERSTANDING THE ECOSYSTEM APPROACH

Traditional management uses the sectoral protection of marine environments; this approach generates certain conflicts over space, resources and environmental degradation that particular activities generate. In addition, sectoral protection is not comprehensive in scope, so it cannot cope with impacts that generate economic consequences (Sukhdev, et al., 2010).

The ecosystem approach considers the human species to be included within the set of species that make up the ecosystem. The management of natural resources is conducted using this approach, and the consequences that human action has on the ecosystem will be analysed. Sustainability is one of the fundamental pillars of management from this approach, with a comprehensive

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

[13] 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.

nature and a holistic method; all of the implications of activities that affect nature are taken into account. This is expected in order to make decisions regarding the management of natural resources when human activities are conducted in a sustainable way. To achieve this, an integrated vision is required, because as we have indicated, all of the species within the ecosystem are linked; Secondly, it must be borne in mind that with this approach, ecosystem services[14] that are vital to economic prosperity must be prioritised. Without an ecosystem, the economy will be affected. Finally, public participation plays a fundamental role in the development of this environmental management model.

The Convention on Biological Diversity[15] (CBD) defines the ecosystem approach as "a strategy for the integrated management of land, water and living resources, which promotes conservation and sustainable use in an equitable way". In marine ecosystems, the International Council for the Exploration of the Sea[16] (ICES) defines it as "the integrated and exhaustive management of human activities based on the best scientific knowledge available on the ecosystem and its dynamics, to identify and act upon the influences that are critical to the health of marine ecosystems, thus achieving the sustainable use of ecosystem goods and services and maintaining the integrity of the ecosystem".

The objectives set for the ecosystem approach are based on: first, the conservation of the biodiversity necessary for the maintenance of ecosystems; second, the ecosystem approach configures the human species as an element included within the ecosystem; third, equity in the use of ecosystem services must be guaranteed if the sustainability of the model is to be sought. In order to guarantee the correct application of the ecosystem approach, 12 principles are established that can be adapted to different contexts and that are complementary to the objectives set out in the CBD since they are directly related and serve to guarantee the application of this approach (Peña Chacón, 2017).

[14] We understand ecosystem services to mean the benefits associated with the management of ecosystems. There are four types of services within the marine environment: provisioning services (collection of fish, shellfish and algae); regulatory services (climate, waste or water quality); cultural services (such as recreational and cultural activities or activities with spiritual benefits) and livelihood services (the nutrient cycle or the marine habitats that fisheries maintain). These services are the basis of the economic model based on natural resources and, consequently, on welfare (PISCES, 2012).

[15] Convention on Biological Diversity (2000) COP 5 Decision V/6 "Ecosystem approach" (22 June 2000) UNEP/CBD/COP/5/23.

[16] ICES (2005) Guidance on the Application of the Ecosystem Approach to Management of Human Activities in the European Marine Environment, ICES Cooperative Research Report, No. 273. 22 pp.

However, the concept of the ecosystem approach is not only configured under the umbrella of the CBD, it is also necessary to refer to the implementation of sustainable development that will serve to balance the model, along with the three main objectives established in the definition given by the CBD (Laffoley, 2004).

Finding the balance in the application of the ecosystem approach is essential to achieve the objectives set and science plays a fundamental role in the development and knowledge of the marine environment in order to design sustainable mechanisms and instruments that can comprehensively establish adapted legal protection mechanisms to the demands made.

4. LEGAL DEVELOPMENT OF UNDERWATER NOISE POLLUTION

4.1. Spain

Anthropogenic noise is a contaminant regulated by acts in Spain. The national legislation is generally established for the terrestrial environment, but formal development for the actual control of noise pollution in the marine environment is required.

The first national act with respect to this matter is Law 37/2003 regarding noise, but this does not apply to the marine environment[17]. This regulation exceeds the scope of the EU regulations in this area (Directive 2002/49 on the evaluation and management of environmental noise) by covering the impacts, not only on human health, but also on the environment within its scope of application. Although the guidelines of the Spanish regulation largely follow those of Directive 2002/49, and it does not currently apply to the aquatic environment, it could serve as a legal basis for developing a specific regulation for underwater noise. Royal Decree 1367/2007, of 19 October, develops Law 37/2003, in methodology and noise limits, but it only concerns environmental noise matters. It includes emission limits for activities, where each case would

[17]Included within its Article 12.2, this law establishes emission limit values, but in Section 3 thereof, it authorises limit values over other activities not contemplated within the regulation. The legislation establishes certain actions regarding the prevention of acoustic contamination on different activities, those that need an integrated environmental authorisation; actions related to the environmental impact assessment (those planned by the autonomous communities are recognised); actions on activities classified as dangerous or harmful and other actions to conduct activities that involve the emission of acoustic pollution. It does not establish a specific authorisation on acoustic limits, but integrates different procedures recognised in Spanish regulations, integrated environmental authorisations, environmental impact assessments, classified activity licences and other sector authorisations in the field of acoustic contamination (Casado, 2004).

be analysed specifically for natural spaces. Spanish noise regulations do not include limits (for new projects) or objectives (for emission points) for either the terrestrial or the marine environment. But the law is clear, the public administration must determine the requirements of these limits within the marine environment when this requirement is justified, for example, by the presence of protected species sufficiently close to the source of the noise, or marine protected areas. With regard to the control of noise at sea, it should be remembered that the decibel levels in water and in air are not comparable[18], due to the different properties of the transmission medium and the different reference levels used.

Law 41/2010 regarding the protection of the marine environment is the principal legislation for the protection of marine ecosystems[19]; and with this law, Directive 2008/56/EC, the Marine Strategy Framework Directive, is incorporated into the national system. The Marine Strategy (MS) is the principal planning instrument for all marine environments, including the seabed, subsoil and natural resources, all of which are subject to Spanish jurisdiction. The MS is one of the more effective planning tools for the entire marine environment, but it must integrate noise considerations when performing such planning, so underwater noise regulation and the impacts thereof, levels and corrective measures must all be an integral and principal focus of these strategies.

The Environmental Assessment, both the strategic and environmental impact of projects, is one of the most consolidated tools of environmental protection. It is necessary to evaluate an activity in order to analyse the environmental impact that it has. This procedure applies to the activities included in the annexes of the respective regulations, which are activities that produce noise within the marine environment (exploitation of marine deposits, marine dredging, oil extractions, etc.). The previous evaluation enables the introduction of new activities or new plans, if they emit sound. The technical and biological parameters of the activities that emit noise into the sea are analysed, these characteristics being defined in André et al. (2009), among others.

Law 21/2013, of 09 December, regarding Environmental Assessment (LEA), aims to establish the basis for an adequate environmental assessment of plans, programmes and projects with significant effects on the environment, with the aim of achieving a high level of environmental protection.

[18] To convert the decibels measured in air to their mathematical equivalent at sea, we need to add 62 dB. Type A decibels are not used at sea to quantify loudness levels, because marine fauna is sensitive to a much broader frequency range than humans.

[19] First mechanism in incorporate a holistic and integral perspective about law of the sea in Spain.

A) Maritime Spatial Planning

The implementation of maritime spatial management in Spain is carried out through Royal Decree 363/2017, of 08 April, a rule that establishes a framework for the management of maritime space. The essence of this regulation is based on the need to promote the sustainable growth of maritime economies, as well as the sustainable development of seas and coastal areas. The most interesting aspect of this rule is established within the management plans, as well as the establishment of planning for these works. A coordinated structure for the management of the marine environment is established through coordination between the different institutions that have jurisdiction in the matter, made possible by Law 41/2010, creating a specific working group on the management of the marine environment. 2020 is established as the year in which the first draft of the maritime spatial plans begins. For this purpose, they will be analysed in order to start the process through the strategic environmental evaluation[20].

Maritime spatial planning is not a new tool, in fact, it has been applied to the management of marine protected areas for a long time and they have even been applied to wider and more complex spaces, such as ocean area planning (Sanz Larruga, 2018). With planning and thorough tools, such as strategic environmental assessment and environmental impact studies, activities that may pose a risk to the balance of ecosystems and a threat to biodiversity can be managed, which, from the ecosystem perspective, may affect socioeconomic aspects and not only the environmental or ecological issues or impacts. It will be within the maritime spatial management plans where the measures to be taken into account in order to prevent those activities that may introduce such a level of noise pollution into the sea that may pose a danger to aquatic ecosystems should be included.

[20] The strategic environmental assessment is provided for in Law 9/2006, of 28 April, regarding the evaluation of the effects of certain plans and programmes on the environment, a standard incorporated as provided for in Directive 2001/42/EC of the European Parliament and of the Council, it appears as an objective and rigorous instrument to assess the environmental impact of the application of plans and programmes. Within this procedure, a series of phases are included that serve to provide status to the comprehensive evaluation, thus, the following are planned: phase one begins where the basic criteria of the plan and the evaluation are established to subsequently create a reference document that will be drawn up, in a coordinated manner, between the different institutions; then, a sustainability report following the provisions of the previous phase; a public consultation, because awareness must be raised regarding the promoted plan in order for it to receive modifications; and lastly, an environmental report is drawn up that collects the plan's proposals in an integrated manner. Once it has been prepared and drawn up, it is sent off for approval.

B) Marine Strategies and Their Impact on Underwater Noise

With Royal Decree 1365/2018, of 02 November, marine strategies are approved in Spain, comprehensive protection over the seas and oceans is increased, they are developed as an essential instrument for marine planning and serve as a complement to measures that have already been in put place on a sectoral basis. Marine strategies are developed as a holistic mechanism and from the ecosystem perspective, which permits a series of actions to achieve the objectives of guaranteeing the good environmental status of the waters. To achieve this, different phases are carried out:

- Initial assessment of marine waters
- The definition of good environmental status
- The proposal of environmental objectives
- Monitoring programmes
- Measurement programmes

In turn, these phases are implemented within the different regions and subregions that divide Spanish marine territory: the Northeast Atlantic (subregion of the Bay of Biscay, the Iberian coasts and the Macaronesian subregion) and in the Mediterranean region (Western Mediterranean subregion). Among the strategies is one dealing with underwater noise, associated with heading 11, which addresses energy and its introduction into seas and oceans. This circumstance must be carried out in such a way that it cannot entail an adverse reaction to the marine environment based on temporal and spatial distribution, both in impulse low and medium frequency noise and taking the evolution of continuous low frequency noise into account.

From all the measures included (a total of 97) in the first cycle of marine strategies in Spain[21], concluded in 2018, with a duration of six years, only one (just 1%) were related to underwater noise: the Regulation on the criteria for underwater noise generating projects and for the preparation of environmental impact studies for projects that may generate or introduce underwater noise. This measure will apply to all marine demarcations and all regions. In the second cycle of the strategies in which we are working[22], the applicable criteria are established in relation to heading 11, these criteria are used to evaluate and define the good environmental condition of the heading[23].

[21] For more information, see the Summary of the Marine Strategy Measurement Programme, first cycle (2012-2018). (Ministerio para la Transición Ecológica, 2018)

[22] The environmental objectives are approved by the Council of Ministers Agreement through the Resolution of 11 June 2019. (BOE, 2019)

[23] See Commission Decision (EU) 2017/848, of 17 May 2017, laying down criteria and methodological standards on good environmental status of marine waters and specifications

It can be detected whether anthropogenic noise in water is impulsive or continuous (low frequency). For this reason, the criteria elements within marine strategies[24] act on two sub-headings. D11C1, "the spatial distribution, temporal extent, and levels of anthropogenic impulsive sound do not exceed levels that adversely affect populations of marine animals. Member States shall establish threshold values for these levels through cooperation at European Union level, taking regional or subregional specificities into account". In the case of continuous low-frequency sound in water, D11C2 is about the spatial distribution, temporal extent and levels of anthropogenic continuous low-frequency sounds not exceeding levels that adversely affect populations of marine animals". States shall also establish threshold values for these levels.

In Spain, the currently existing regulations do not contemplate levels or quantitative thresholds for underwater anthropogenic noise as an impact evaluation system. This is also the case in the European Union, but some countries have established guidelines or protocols with the effect of cushioning and minimising the impacts that noise can cause, especially activities that cause levels that are most damaging to the marine environment. Countries such as the US, the United Kingdom[25] and New Zealand have incorporated mechanisms that limit the levels that can be generated as quantitative thresholds (Redondo & Ruiz Mateo, 2017).

The criteria for both D11C1 and D11C2 are observed in the indicators used for the evaluation of the second cycle of marine strategies, and in the first of these, with the SABIA Project, an information system is created to process environmental evaluation procedures. The environmental assessment files are consulted through this procedure, and a geo-reference is obtained to obtain the data for the processing of the file. In the case of D11C2, a series of maps has been generated to analyse the density of maritime traffic, thanks to the QUITMED project. For both criteria, it has been established that the threshold values to determine the good environmental status of the sea must be agreed at the community level and not by individual countries. To enable this option, the TG-NOISE technical group has been formed, but a consensus to implement those values has not been achieved.

and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU (Text with EEA relevance).

[24] COMMISSION DECISION (EU) 2017/848, of 17 May 2017, laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU.

[25] See Merchant, et al. (2016)

In the middle of 2020, the development of marine strategies, specifically heading 11, has not been as advanced as might be expected. This fact is due in part to a complex reality, since marine management must be based on the essential pillar of coordination, which, as has been evidenced, requires extensive cooperation between territories that share the marine environment. As Sanz Larruga (2019) points out, it is worth considering the idea that the ineffectiveness of the measures adopted so far are derived from inadequate governance of the marine environment, since the measures as we observe, focus on territorial jurisdictions, ignoring the global nature thereof and the need for a response at multiple levels (Vaquer Caballería, 2016).

4.2. Norway

In Norway, maritime planning is positioned as the quintessential process of coordination and management of human activities with an impact on aquatic ecosystems. In the marine environment, this planning is not as different as it can be on land, except for the difference in the complexity of the marine ecosystem. This system is comprised of adaptive management to the situation, depending on the risks or situations that may have impacts on marine ecosystems. It is a multisector system since it contains different plans with specific projects (Schütz & Slater, 2019).

The United Nations Convention on the Law of the Sea (UNCLOS) emerges as an instrument of global governance over the oceans, taking a holistic approach to the management thereof (Maes, 2008). International law has been used to incorporate regional mechanisms for the protection of the seas and oceans. Through instruments such as the Convention on Biological Diversity, already discussed above, and also others such as the OSPAR agreement, it serves as the basis for the implementation of the sphere of environmental protection[26]. From the European Union, the minimum mechanisms have also been established to achieve the most effective and efficient maritime planning possible, implementing solid maritime legislation. However, these mechanisms may not have been incorporated into the EEA agreement. Through marine management mechanisms, the activities and uses of the marine environment have been developed and managed in accordance with sustainability and the good condition of the sea. Management plans have been implemented for some time, not only at the terrestrial level, but also within the marine environment and recently the impacts of obtaining energy through renewables such as marine and ocean ecosystems or wind farms constructed in the seas, have been analysed with great interest (ICES, 2017).

[26] See the European Union and the Regulation of Underwater Noise Pollution, (Papanicolopulu, 2011)

Although it is true that noise pollution has not been analysed specifically, the risks of this type of pollution on ecosystems have been evaluated within the analysis of impacts of anthropogenic activities. Management plans have long been the quintessential mechanism used in Norway[27], with analysis prior to the granting of activity operating licences. Maritime planning has been regulated since 2008 through regional regulations, the primary regulation being the Norwegian Planning and Building Act (section 1-2), hereinafter referred to as the PBA, which implements Directive 2000/60/EC, under the EEA treaty. The regional and municipal plans are carried out under the aforementioned regulations that set the minimum requirements to be met.

Since the ratification by Norway of the OSPAR Convention, various studies have been conducted that show the negative impact that the introduction of energy into the marine environment can have, especially noise in the sea and ocean. The objectives set by the EEA on environmental law in its Article 73 indicate that they must preserve, protect and improve the quality of the environment and guarantee a rational and prudent use of natural resources. To this, we add that the interpretation of European Union law in a secondary sense, namely, European Directive 2000/60/EC, which establishes the action framework for water policy, is an example to guarantee the good condition of the seas, as well as Directive 2008/56/EC regarding marine strategies, but they have not been incorporated into the EEA agreement (Nordtveit & Schütz, 2018). Analysing the EEA agreement, Article 74 establishes the protection measures to take into account that are included in Annex XX, where the European directives were included until the date of the signing of the regulatory text. The differences between the environmental law of the EU and the EEA represent a challenge to be addressed, especially given that a series of different related regulations overlap within the community sphere, which gives consistency to the effectiveness of the objectives set and, in addition, they grant other instruments that increase their efficiency.

The EEA agreement does not include the most recent regulations, especially those already mentioned, regarding marine strategies and maritime spatial planning, nor others that go along the same lines. However, as with the pre-licence evaluation, we see how all of the aspects that can generate danger for the good environmental status of the system are taken into account, such as noise inference within existing ecosystems. One of the required mitigation measures are geographic and seasonal restrictions (Bjørke, Dalen, Bakkeplass, Hansen, & Rey, 1991) (Dalen, Ona, Vold Soldal, & Saetre, 1996), which can be assigned to specific areas or even be taken into account in the licence conditions (Anon, 1985). It is true that the problem of growing intensity of noise at sea is missing within the existing environmental regulatory framework in Norway,

[27] See the Integrated Management Plan for the Barents Sea.

since only the EEA agreement on environmental noise is referred to[28], with a clear anthropocentric bias, diminishing the ability of countries within the Community that have this marine management instrument, which is fundamental to increasing the efficiency and effectiveness of the measures already incorporated through maritime spatial planning, to address the ecosystem issue in a way that they would do so if they did so through the MSPD.

Unlike Spain, Norway does not have specific regulations in its legal system for the control of underwater noise, since the European directives on the environment have not been incorporated into the Nordic regulatory framework, with Norway refusing to specifically incorporate some, such as the regulations on marine strategies (Schütz, 2018). We wanted to continue with the system of maritime spatial planning, which, from our perspective, is the fundamental pillar of the issue, as it presents the greatest comprehensive vision of the problem and ecosystems.

5. CONCLUSIONS

Maritime spatial planning has been the fundamental pillar in the management of the marine environment, it serves as a priority instrument as it can focus on the ecosystem approach and this has been done across the planet for more than half a century. This instrument must be the priority in the governance of the marine environment, where it must address noise as one of the elements to take into account when granting licences for activity.

The existing coordination in Norway, where the implementation of management plans has a longer trajectory, is one of the most solid points in the effectiveness that they demonstrate in managing the anthropogenic impacts on marine ecosystems. The influence of municipalities in environmental management is one of the pillars of governance that has been promoted in the Nordic country, by facilitating administrative procedures between the different administrations that participate and this system has been adopted by other countries. On the contrary, in Spain, this coordination is one of the points that needs improvement, leaving the strict jurisdiction aside and looking for governance formulas has been a challenge to be faced and, with the marine strategies, we have wanted to promote this increase in efficiency in protecting seas against underwater noise.

[28] Noise is included in chapter VI of Annex XX (EEA agreement), it includes only the legal act – Directive 2002/49/EC relating to the assessment and management of environmental noise.

The complexity of this theme leads us to consider looking for simpler formulas in co-management and combining them, adding that, firstly, the distribution of Spanish powers does not facilitate the application of Community regulations, and as an example, we see the delay in the application of holistic and comprehensive standards within the Spanish legal system. It was not until 2010 that the first marine protection standard with a holistic and comprehensive scope was incorporated and, a decade later, mechanisms have not yet been implemented beyond those promoted by other standards that address underwater noise in a secondary manner, such as perhaps through environmental assessment procedures and environmental impact studies in the activities to be analysed. In addition, the fragmentation of existing regulations in Spain has also been one of the problems to be taken into account when it come to the effectiveness of the regulations. It has been indicated that the regulations regarding maritime spatial planning should have been regulated by law and not by royal decree (Menéndez Rexach, 2016).

The direct impacts generated on marine ecosystems by anthropogenic noise can indirectly reach other ecosystems, generating an impact on the human species itself. This is the essence of the ecosystem and, therefore, it is necessary to achieve even greater efficiency than stipulated in the instruments already available for environmental management regarding underwater noise levels, guaranteeing this "balance". Noise is not absent from the marine environment, as water is a fundamental element for the propagation of sound and marine ecosystems are very sensitive to external influences, especially those linked to anthropogenic factors (Morelle Hungría, 2019). In the management of underwater noise, it is necessary to establish these limits or threshold levels, especially in order to limit activities that may generate negative impacts on the marine environment. Science has demonstrated the impacts that different human activities can generate on aquatic ecosystems, as well as the need to incorporate these limits to guarantee the efficiency of the maritime management instruments that we have analysed (Merchant, et al., 2016).

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