Underwater Noise -
The neglected threat to marine life

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Abstract

Anthropogenic underwater noise is a major conservation problem having serious impacts on marine species in all oceans. Noise comes from offshore construction, transport as well as resource exploration and extraction, and adds to the cumulative environmental impacts from other anthropogenic pressures. The EU Marine Strategy Framework Directive requires anthropogenic noise to be at levels that do not adversely affect the marine environment. However, the focus to date has been on monitoring with no widely agreed ways yet to assess whether Good Environmental Status is being achieved with respect to underwater noise. While such assessments are ongoing, there is considerable scope for reducing noise at source, which is usually the most effective way of reducing impacts to marine species and habitats. In this paper, we will first summarise main noise sources and their impacts on the marine environment, we will then identify shortcomings in current underwater noise regulation and mitigation, and finally recommend ways to more effectively implement current legislation in order to apply concrete measures to protect our oceans from excessive noise. Specifically, we recommend using risk maps and noise budgets to address cumulative noise impacts, setting noise thresholds immediately, preventing any widespread increase in noise, particularly by reducing and preventing noise at source, managing noise at the ecosystem level through spatio-temporal measures, and regional and interregional coordination and collaboration.

1. State of knowledge

Anthropogenic underwater noise has been recognized as a critical pollutant, negatively impacting global marine ecosystems [1]. Consequently, over the last two decades, the problem has become a significant focus for the marine research community, policy makers, and the public [2]. However, determined action to improve the situation is still lacking.

A wide range of activities producing underwater noise has been shown to adversely affect marine species at the individual and population level [3–7]. On a global scale, underwater noise from commercial shipping is one of the most pervasive noise sources [8,9]. Seismic surveys can also affect marine ecosystems across trophic levels and over large areas [10,11], while pile driving during offshore construction, military activity and explosions, acoustic deterrent devices (ADDs), and smaller vessels (with echosounders for depth ranging and fish finding) are significant sources of underwater noise for local and regional ecosystems [12].

<u>Continuous noise</u>

In most European waters, shipping constitutes the major continuous noise source from human activities [13–15]. A recent model of noise levels in the North-East Atlantic, based on Automatic Identification System (AIS) ship-tracking data, found noise hotspots in the English Channel and the Norwegian Trench, around major European ports as well as oil and gas infrastructures in the northern North Sea [16]. In parts of these areas, median broadband (63-4,000 Hz) noise levels exceeded 120 dB re 1 µPa[1] for 50% of the year. Recreational vessel traffic, which is often not accounted for in noise models that focus on large vessels, can be a major contributor, particularly to shallow coastal soundscapes, and significantly elevates noise levels in the mid-to-high frequencies [17]. In addition to shipping, other continuous noise

[1] Continuous noise levels exceeding 120 dB re 1 µPa are currently used as a threshold for behavioural disturbance to marine mammals by the US National Oceanic and Atmospheric Administration (NOAA) (NMFS, 2018).

sources include operational offshore structures such as oil and gas platforms, tidal turbines, and windfarms [18–20]. Initial regional research projects (e.g., BIAS, JOMOPANS, JONAS, and QUIETMED) have produced measurements of ambient underwater sound levels for the Baltic Sea, the North-East Atlantic including the North Sea, and the Mediterranean Sea. However, long-term data on ambient underwater sound and a definition of baselines are still lacking.

Impulsive noise

Impulsive noise sources, including explosions, seismic airguns, pile driving, military sonar, and ADDs, all contribute to ecosystem-scale noise pollution in European seas [21]. Sounds from some of these sources, such as seismic airguns, propagate over very large distances, and have been recorded up to several thousand kilometres from the source [22]. Others, such as ADDs are operated continuously along large stretches of coastline, introducing significant levels of chronic underwater noise into the marine environment [23]. Comprehensive measurements of larger-scale impulsive noise sources can be difficult and consequently are often lacking. As a first step, an impulsive noise events registry with the aim to summarise impulsive noise generating activities supplied by Contracting Parties (CPs) to the respective Regional Seas Conventions (RSCs) namely the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the Baltic Marine Environment Protection Commission (HELCOM) was recently implemented and is hosted by ICES[2]. A similar system has been developed for the Mediterranean Sea [24]. First results show that activity levels across the North-East Atlantic are highest in the North Sea. Reported activity was dominated by seismic airgun activity, while pile driving and explosions have been shown to increase in recent years, particularly in the southern North Sea [21]. However, data reporting is not coherently done by the CPs of the RSCs and not all relevant impulsive sound sources are so far included, which prevents an assessment of cumulative impulsive sound as well as the identification of mitigation and reduction needs.

Impact of underwater noise on marine life

The perception and production of sound is a vital component of the sensory ecology of all marine animals in their different life stages. For example, reef soundscapes influence larval orientation and settlement behaviour [25]. Several fish species produce vocalisations in defence of territories or food, in a mating context, or during predator-prey interactions [6,26]. Similarly, marine mammals, especially cetaceans, have evolved to use sound as their primary sensory modality. Most species possess complex communication systems to find food, navigate, maintain group cohesion and social bonds, and to mediate mating behaviour [27]. Thus, collectively, marine invertebrates, crustaceans, fish, and marine mammals fill the ocean with sound. These sounds spread over a wide range of frequencies: from the very low frequency (10-30 Hz) songs of the blue whale, to gadoid and toadfish grunts and humming choruses (50-500 Hz), to the high frequency clicks (120-150 kHz) of porpoises. This means that the sounds and hearing ranges of marine life intersect with nearly all sources of human-made sound.

Many reviews have compiled findings of the large body of scientific literature demonstrating noise impacts on marine ecosystems and species. These reviews highlight that underwater noise from human activities can impact individuals and populations of marine organisms in complex ways. Impacts have been observed on all trophic levels, from invertebrates to fish,

[2] https://ices.dk/data/data-portals/Pages/impulsive-noise.aspx

marine mammals, and diving seabirds [3,5–7,28–30]. Whereas in marine mammals and seabirds, hearing and noise impacts depend on detection of the pressure component of sound [29,31], many marine fish and invertebrates primarily sense and are impacted by noise through particle motion [32]. Independent of modality, the severity of noise impacts typically decreases with distance from source. However, behavioural responses in particular are not easily scaled with distance or received sound level but depend on the individual, the context, the type of sound, and the acoustic environment in which it is produced [33,34].

In summary, available evidence shows that noise can reduce communication ranges and mask (obliterate or obscure) important signals [35,36], disrupt reproductive and resting behaviours, including of mother-calf pairs [37], affect energy budgets by interfering with foraging [38,39], and exclude animals from important habitats, which in some cases may increase their exposure to other human impacts [40]. In addition, stress responses, which weaken overall health and fitness, have been observed in several species [41,42]. Noise can also cause temporary loss of hearing sensitivity and permanent loss of hearing ability [43], induce physical injury [44], and, in extreme cases, cause behavioural or physiological responses that may lead to death [45].

Finally, underwater noise impacts from individual sources often continue over long periods and overlap with other noise sources or forms of human activity and pollution. The resulting cumulative impacts and degradation of acoustic habitats [46] have long been recognised as a serious transboundary conservation problem, for which committed action and international collaboration is needed [1].

2. The current legal and policy frameworks on underwater noise

Underwater noise in EU law

In the European Union (EU), the main legal framework addressing underwater noise is the Marine Strategy Framework Directive (MSFD; 2008/56/EC). Adopted in 2008, the MSFD is the first piece of EU legislation to recognise underwater noise as a pollutant that endangers marine life, degrades the marine environment, and should be managed. The Directive sets out to protect the marine environment across Europe and aims to achieve Good Environmental Status (GES) in EU marine waters by 2020, where the overall GES is defined as "The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy, and productive". Annex 1 of the Directive outlines 11 qualitative descriptors that delineate what a thriving and unpolluted marine environment should resemble and by which GES shall be determined. Descriptor 11 states that GES is qualitatively achieved when the "Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment".

In 2017, the European Commission revised its original Commission Decision from 2010 on the criteria and methodological standards of GES of marine waters[3] to further support Member States (MS) in implementing the Marine Directive. For underwater noise, two primary criteria should be used to assess GES:

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1495097018132&uri=CELEX:32017D0848

- Criterion D11C1[4] is for short duration, loud, low, and mid-frequency impulsive noise, as caused by e.g., seismic surveys, marine piling, sonars, explosions, etc.
- Criterion D11C2[5] is for long-lasting, low frequency continuous noise, mainly caused by commercial shipping and impulsive sources at long range in some regions.

The revised 2017 Commission Decision requires MS to establish threshold values for the GES criteria of the 11 descriptors of the MSFD whereas the original COM DEC only asked for trend assessments. Threshold values, which are now mandatory through the new provisions, are intended to contribute to the determination of a set of characteristics for GES by the MS and enable their quantitative assessment to distinguish between GES being achieved or not achieved, the latter triggering a need for targets and measures.

To support MS in the implementation of the MSFD, soon after its adoption, the European Commission set up a number of technical working groups in which MS representatives, experts and stakeholders meet to exchange knowledge, learn from one another and develop harmonised approaches and common methodologies when needed. One of these is the Technical Group on Underwater Noise (TG Noise) whose work programme includes the development of common assessment and monitoring methodologies, EU-level baselines, and threshold values for D11C1 and D11C2. So far, TG Noise focused its activities on developing advice on monitoring methods for underwater sound in European Seas. More recently, the work in TG Noise has focused on the development of a methodology that could be used for threshold values for the two criteria at EU-level.

In addition to the MSFD, the other legal frameworks that may be used to regulate underwater noise impacts in EU waters are the Habitats, the Strategic Environmental Assessment (SEA), and Environmental Impact Assessment (EIA) Directives. Despite important differences, the three Directives work on the basis of assessing the environmental impacts and risks of an activity before it starts operating. The EIA/SEA Directives in particular should provide for an analysis of the spatial and temporal extent of impacts on the entire marine ecosystem from noise-producing projects. They are essential tools to guarantee fulfilment of the legal obligations under other EU legislative acts, in particular the MSFD[6].

Other regional and international frameworks addressing underwater noise

In parallel to EU law, several international and regional agreements and processes also address underwater noise.

At the regional level, the RSCs play an important role in the implementation of the MSFD, which has enshrined the principle of regional cooperation and delegated several tasks to the RSCs. OSPAR already included a first assessment of underwater noise in its Quality Status Report 2010, stating that overall noise levels are thought to increase and that there are signs of effects on marine life[7]. To date, one common indicator on distribution of impulsive sounds has been adopted under this Convention. Although OSPAR has a mandate to work on

[4] D11C1: "The spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals."

[5] D11C2: "The spatial distribution, temporal extent, and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals."

[6] Oceancare, IFAW, Seas At Risk, NRDC, "Reduce the Noise – European countries' failure to address marine noise pollution", January 2019.

[7] https://qsr2010.ospar.org/en/ch09_11.html

mitigation measures and develop a Regional Action Plan on underwater noise, so far only an inventory of underwater noise mitigation measures without taking further action has been developed.

In HELCOM, work is ongoing to establish a first operational core indicator on distributions of impulsive sounds until the next Holistic Assessment (III) in 2021. A draft Regional Action Plan is already available. Pending its adoption, it could offer a real chance to start working on pilot projects and subsequently on concrete measures. Simultaneously, the revision of the Baltic Sea Action Plan (BSAP) is ongoing and several suggestions for measures to reduce underwater noise in the Baltic Sea are being discussed. The revised BSAP will be adopted in 2021.

In addition to the RSCs, parties to the Convention on Migratory Species (CMS), including all EU MS as well as the European Union, have made a commitment through resolutions to avoid, reduce and mitigate negative impacts of anthropogenic noise on migratory species, as well as endorsing specific guidelines, such as how to undertake EIAs prior to noise-generating activities[8]. Parties to the regional CMS daughter agreements focusing on the conservation of cetaceans, ASCOBANS and ACCOBAMS, have also committed to reducing noise and the resulting negative effects in the respective agreement areas[9,10]. Further, governments and the Private Sector are encouraged, by decisions adopted by Parties to the Convention on Biological Diversity (CBD) as well as CMS to promote the development of quieting technologies and apply best environmental practises.

In 2009, the International Maritime Organisation (IMO) developed non-mandatory technical guidelines for ship-quieting technologies, as well as potential navigation and operational practices to reduce noise emissions from shipping. These guidelines are now subject to a revision process because little progress has been made in implementing them.

The International Whaling Commission (IWC) adopted a resolution on anthropogenic underwater noise in 2018. Setting priorities for addressing this threat is included in the Strategic Plan of the IWC Conservation Committee.

3. Shortcomings of underwater noise management in Europe

Overall, the implementation of the MSFD is the driving force in Europe today to address underwater noise. However, the Programmes of Measures (PoMs) imposed by MS to achieve GES include few actions that actually prevent or reduce noise emissions. Currently, the PoMs lack standardisation and predominantly focus on monitoring activities.

The European Commission's recent progress report on the implementation of the MSFD shows that the objective of achieving GES for Descriptor 11 by 2020 will not be reached by any of the MS despite the Commission's acknowledgement that *"given that most human activities causing continuous and impulsive underwater noise are expected to increase in the future, it is probable that the pressure from underwater noise will also increase"*[11]*.* In the Commission Staff Working Document accompanying this report, the European Commission further shows

[8] https://www.cms.int/sites/default/files/document/cms_cop13_doc.26.2.2_rev.1_marine-noise_e.pdf

[9] https://www.ascobans.org/en/documents/agreement-text

[10] https://www.accobams.org/wp-content/uploads/2017/01/ACCOBAMS_Text_Agreement_English.pdf

[11] European Commission, *Report on the implementation of the Marine Strategy Framework Directive (Directive 2008/56/EC)*, COM (2020) 259 final, 25 June 2020.

the limited progress made by MS in monitoring and assessing noise levels and in taking mitigation measures to limit them. According to the European Commission, 12 years after the adoption of the Directive "*the assessment of underwater noise across the EU is at an early stage and focuses on identifying and characterising sources and the (likely) spatial distribution of this pressure. There is a significant lack of monitoring programmes and data*."[12]

Additionally, criteria addressing the biological impacts are missing for Descriptor 11 on underwater noise. Therefore, obligatory requirements for the monitoring and assessment, as well as for the derivation of threshold values for impacts, are lacking.

Nevertheless, first steps have been achieved recently with the set-up of noise registries. The impulsive noise events registry hosted by ICES assembles data supplied by CPs to OSPAR and HELCOM. The data are collated nationally from registers of licenced events such as pile driving, seismic airgun surveys, controlled explosions, and other activities that release energy. A similar noise register is currently being developed for the Mediterranean Sea. However, despite these encouraging developments, it is urgently necessary to join knowledge and forces for a European impulsive noise registry. This would enable better management and coordination of impulsive noise-producing activities across Europe. It is also recommended that EU MS submit details of proposed sound-generating activities as well as those that have already happened, since otherwise the registers will be of limited use in regulating such activities to reduce environmental impacts.

In addition to the lack of data, it is of particular importance to mention that, despite the fact that sufficient knowledge on the harmful impacts of underwater noise on marine life is available, there are currently hardly any binding source-based management approaches to prevent and decrease underwater noise emissions within the European Union.[13] As mentioned above, the IMO has made recommendations and developed guidance for reducing vessel noise, which so far have largely been ignored. MS have not designed general noise-reducing shipping and port operation strategies.

Legislative tools such as SEAs and EIAs have only received limited attention in the marine PoMs and MS have largely failed to apply time-area closures for noise-generating activities, despite widespread recognition that these are some of the most effective conservation measures to prevent negative underwater noise impacts on marine species and reduce risks to the marine environment as a whole.

Lack of progress in the adoption of threshold values

Member States have a responsibility under the MSFD to coordinate at the European, regional and sub-regional level in developing threshold values for underwater noise to assess whether noise levels are or are not at levels that will cause harm to marine biota. TG Noise has been tasked with providing guidance on methods for setting such threshold values. Although it is well documented that noise can have a multi-species, ecosystem-wide impact, the details on impacts are variable, species dependent, and noise source dependent. Especially in this

[12] European Commission, Commission Staff Working Document, *Review of the status of the marine environment in the European Union Towards clean, healthy and productive oceans and seas – Accompanying the Report from the Commission to the European Parliament and the Council on the implementation of the Marine Strategy Framework Directive (Directive 2008/56/EC)*, SWD (2020) 61 final PART 3/3, 25 June 2020.

[13] OceanCare, International Fund for Animal Welfare (IFAW), Seas at Risk (SAR) and Natural Resources Defense Council (NRDC), *Reduce the noise – European countries' failure to address marine noise pollution*, January 2019.

context, guidance on indicator species for biological impacts is needed, which so far, is underrepresented in the work of TG Noise. Currently OSPAR is developing a candidate indicator for impacts from impulsive sounds but equivalent work in other areas and on continuous noise is still at an early stage.

Although there is ongoing research related to underwater noise, there has been little progress on impact assessment methodologies in 10 years such that most countries were not able to make a conclusion on whether GES would be achieved or not by 2020 in the last round of MSFD reporting in 2018[14]. Much of the research focus has been on monitoring noise trends, which can take decades to discern, rather than on taking preventative action to reduce noise at source. With the exception of noise thresholds adopted by Germany, Netherlands and Belgium to prevent harm to harbour porpoises from pile driving, there are currently no binding, source-based management approaches to decrease underwater noise emissions in EU MS. The noise thresholds that have been developed have been instrumental in promoting quieting technologies. For example, innovations in technologies to quiet pile driving or quieter alternatives to pile driving were developed as a direct result of Germany's noise threshold legislation.

Comparison to progress with MSFD Descriptor 10

A useful comparison is with Descriptor 10 on marine litter. In 2008, both topics (marine litter and underwater noise) could be considered in a similar underdeveloped state in terms of knowledge, assessment methodology, and data availability. Twelve years later, the difference in the measures put in place by MS to tackle the two issues is massive and growing. For instance, all EU MS are in the process of implementing strong prevention and reduction measures on marine litter under the MSFD as well as the Plastics Strategy. These include the revised Port Reception Facility Directive (for improved waste management in ports and to prevent illegal discharges at sea), the Directive on the impacts of certain plastic products on the environment (single-use plastics and fishing gear), and the related REACH process (on intentionally added microplastics). Moreover, other legislation such as the revised waste and packaging directives is now addressing marine litter. One main reason for this, of course, has been the worldwide public attention to the issue of marine plastic pollution from 2013 onwards, galvanised by civil society, public authority, and celebrity engagement. Recently a European threshold value for beach litter was adopted and others for biological impacts are in preparation.

While it is very difficult to attain similar levels of public engagement on the invisible issue of noise pollution, the work on marine litter shows MS are capable of taking ambitious measures and standing up to powerful economic interests in order to protect the marine environment. Yet, practical and realistic solutions also already exist to reduce noise levels at source that only need political will to be implemented (see Section 4).

[14] Commission staff working document „Review of the status of the marine environment in the European Union Towards clean, healthy and productive oceans and seas" accompanying the Report from the Commission to the European Parliament and the Council on the implementation of the Marine Strategy Framework Directive (Directive 2008/56/EC)" – p120.

4. Recommended actions and measures needed

In conclusion, despite wide recognition of underwater noise as an important marine pollutant with significant risks for marine ecosystems, and considerable work done to establish monitoring in European waters, effective and coordinated action in the form of concrete strong reduction measures is still lacking.

In the second cycle of MSFD implementation with clear indications that GES for D11 is far out of reach, it is therefore important to now define and implement comprehensive PoMs and Regional Action Plans to allow effective and actual implementation of MSFD requirements. Specifically, we recommend the following actions to progress transboundary noise management in European seas on the path to achieving GES.

I. Assessment of noise budgets and production of risk maps

Risk maps and noise budgets have been recommended as a way to propose quantitative targets to address cumulative noise impacts [47,48]. This approach takes into account the spatio-temporal characteristics of sources and species. We recommend the continued development of internationally shared noise registries compiling past, present and future noise-generating activities. Agreement on the continued maintenance and financing of long-term stations for measuring ambient underwater sound needs to be reached on a regional level to define baselines and allow for comprehensive assessments.

National and regional noise monitoring efforts must continue to use transparent and shared standards that allow for an assessment of cumulative sound impacts and lead to concrete noise reduction targets and actions that reduce underwater noise if threshold values are exceeded. Additionally, similar to the Energy Efficiency Operational Indicator (EEOI), a real-time monitoring system, which allows ship operators to listen to the underwater noise generated by the vessel, would raise awareness and incite voluntary action by ship operators.

II. Definition of baselines and setting of threshold values to define binding reduction targets

A timely and pragmatic approach to setting thresholds is necessary. It should be combined with management strategies that prevent any widespread increase in underwater noise and should address areas that are currently suffering from high levels of anthropogenic noise. Noise thresholds need to have a scientific basis that takes into account current uncertainties about impacts on sensitive species and the wider ecosystem. TG Noise is working on this but needs to be given a timetable with deadlines to ensure progress, in addition to clearer guidance on what is required in terms of advice. An approach for threshold values for Descriptor 11 under MSFD that ensures no increases in overall noise impacts should be adopted as an interim measure while thresholds that are more refined are developed.

III. Prevention and reduction of noise at the source

Noise reduction at the source is the most effective approach to reducing impacts. We recommend continued development and prioritised use of noise-reducing technologies for pile driving, construction, explosions, and seismic surveys. The latter should be subjected to a complete ban in relation to further exploitation of oil and gas due to the necessity of meeting the climate objectives set within the Paris Agreement. Noise limits (consider pile-driving noise limits set by Germany, Belgium and the Netherlands as examples) should be established and enforced to encourage technological development for source level reduction of noise-

producing activities. With respect to shipping noise, we recommend implementing IMO Guidelines for ship quieting technologies and operational measures, such as speed optimization and reduction via a European wide port strategy, resulting in multi-environmental benefits, including noise emission reduction.

The use of Best Available Techniques/Technologies (BAT) and Best Environmental Practice (BEP) is a requirement recognised and promoted in several international agreements and conventions, such as the CMS and CBD. Several of these BAT and BEP exist for noise sources already, and should be made use of to reduce noise [47]. An example of BAT would be quieter alternatives to seismic airguns, such as marine vibroseis; an example of BEP would be slow steaming, or the reduction of ship speed to reduce noise [48].

IV. Application of spatio-temporal management approaches

Current mitigation which assumes animals can move away is ineffective in circumstances where this is impossible or where displacement also causes significant harm [40], which is likely the case, both by being driven from prime foraging or breeding areas as well as the excess time, energy and missed opportunity costs associated with displacement. As an alternative, impacts on sensitive species can be reduced by spatial or temporal separation of source and receptor. Field research and species distribution modelling to identify 'quiet areas' [49] and areas of biological importance, particularly for small or vulnerable populations [40,50] should be prioritised. Such data are essential to prioritise time-area closures for noise-producing activities or to propose alternative shipping routes to protect sensitive species and their habitat. Noise reduction in Marine Protected Areas (MPAs) where noise-sensitive species are protected should be realised through re-routing and speed reductions for shipping where appropriate. MPAs should be managed with noise in mind, including noise buffer zones.

Prior to licensing noise-generating activities, robust, comprehensive and transparent EIAs should be required. Current national EIA processes need improvement and should be harmonised at an EU level. For example, despite being recognised as an important sense for many species, at present, particle motion is only rarely included in EIAs. Focus must be shifted from consequences solely on the population level to assessing impacts on individuals and consequences at the ecosystem level. Furthermore, noise management should be based on the precautionary principle. The "CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities" endorsed with the adoption of UNEP/CMS/Resolution 12.14 on "Adverse Impacts of Anthropogenic Noise on Cetaceans and Other Migratory Species" would serve as an appropriate model. To harmonise EIA procedure, we strongly encourage EU MS to make these Guidelines mandatory.

V. Regional coordination and interregional cooperation

As stated above, the RSCs play an important role in the implementation of the MSFD and in taking their own dedicated action to prevent and reduce emissions of underwater noise. Especially for noise pollution where sources and spread of the pollutant, as well as recipients are not stopped at national borders, regional coordination and interregional cooperation are needed. The RSCs thus need to help in harmonising the above-mentioned actions for a common understanding and approach for monitoring, assessing and reducing underwater noise and to implement their own targeted Regional Actions Plans.

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List of abbreviations

ADDs	Acoustic deterrent devices
AIS	Automatic Identification System
BAT	Best Available Techniques/Technologies
BEP	Best Environmental Practice
BSAP	Baltic Sea Action Plan
CBD	Convention on Biological Diversity
CMS	Convention on Migratory Species
CPs	Contracting Parties
EEOI	Energy Efficiency Operational Indicator
EIA	Environmental Impact Assessment
EU	European Union
GES	Good Environmental Status
HELCOM	Baltic Marine Environment Protection Commission
IMO	International Maritime Organisation
IWC	International Whaling Commission
MPA	Marine Protected Area
MS	Member States
MSFD	Marine Strategy Framework Directive
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PoMs	Programmes of Measures
RSCs	Regional Seas Conventions
SEA	Strategic Environmental Assessment
TG Noise	Technical Group on Underwater Noise

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