

**ECOREGION**                    **Introduction and general advice**  
**SUBJECT**                      **EU request to ICES for review of the Marine Strategy Framework  
 Directive Descriptor 11 – Energy, including underwater noise**

Preparatory to a revision of the Decision on criteria and methodological standards on good environmental status of marine waters (Commission Decision 2010/477/EU) the European Commission has set up a process to produce a science-based evaluation and amendment proposal for the descriptors described in the Decision.

ICES was asked to facilitate this process regarding descriptors 3 (Populations of commercially exploited fish and shellfish), 4 (Foodwebs), 6 (Seafloor integrity), and 11 (Energy, including underwater noise). ICES has in this respect received a request from the European Commission:

*The MSFD Committee discussed in 2013 and concluded an approach and an outline for the process of a review and possible revision of Commission Decision on criteria and methodological standards on good environmental status of marine waters (2010/477/EU) and of MSFD (2008/56/EC) Annex III.*

*The Commission (DG ENV and JRC) in association with ICES will organise and steer the process. At technical level a systematic analysis of the current GES Decision needs to be carried out reviewing all parts of the Decision, taking into account latest scientific and other developments. The review will aim to define GES criteria more precisely, including setting quantifiable boundaries for the GES criteria where possible and specifications and standardised methods for GES assessments in particular as regards temporal and spatial aggregation. The first phase of the exercise is scheduled from May to October 2014. Subsequent work will be decided then.*

*ICES will be responsible for the relevant work related to the review of the descriptors D3 (fisheries), D4 (food webs), D6 (seafloor integrity) and D11 (noise). For D11 the work will build on the continued work of the Technical Group on Noise (TG Noise).*

*ICES is therefore requested to provide an offer covering the following tasks for the first phase of the GES review:*

- a) prepare draft documents for each of the above-mentioned descriptors (see outline enclosed);*
- b) organise open workshops with experts from all interested EU member states to consult of the draft documents;*
- c) provide recommendations for revision with a proposed draft text with changes and the rationale for these changes to the Commission;*
- d) provide feedback to WG GES (and the preparatory drafting group) which is the forum to oversee the organisation and planning of the technical review process.*

*ICES will also have to participate and contribute actively in the internal coordination process with the JRC, the EEA and DG ENV.*

The process to produce the amendment text regarding Descriptor 11 was:

- A template for evaluation and amendment proposal was provided by the European Commission.
- The EC Technical Group on Noise (TSG Noise), co-chaired by an ICES Advisory Committee (ACOM) Vice-chair, included the review into their ongoing work.
- The group finalized the review by completing the template provided by the European Commission.
- The draft text for amendment was posted to ACOM for information and comments.
- The amendment text was then finalized by TSG Noise and delivered to the European Commission.

The outcome of this process is enclosed and will be published by the European Commission

### **Sources**

EU. 2010. Commission Decision on criteria and methodological standards on good environmental status of marine waters. Commission Decision 2010/477/EU of 1 September 2010. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF> .

## Possible approach to amend Decision 2010/477/EU

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### Descriptor 11: Energy, including underwater noise

<b>Author</b>	<b>Version</b>	<b>Date</b>
Milieu	V1	23.05.2014
Mark Tasker	v2 draft (taking account of D. Connor suggestions)	15 July 2014
Mark Tasker	v3 draft; new text in Part 2	24 July 2014
Mark Tasker	v4 draft, accommodating MAx3, RL, VP, JP, FTx2, MA, RD comments,	1 September 2014
Mark Tasker	v5 responding to comments from Germany, RD, MC, RL	27 September 2014

## Review of Decision 2010/477/EU

## Descriptor 11: Energy, including underwater noise

<b>Title of Descriptor</b>
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*Good environmental status for Descriptor 11: Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.*

<b>Approach</b>
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**Definition of the Descriptor**

There are many kinds of anthropogenic “**energy**” that human activities “**introduce**” into the marine environment, including sound, light, other electromagnetic fields, heat, and radioactive energy. Energy inputs can occur at many scales of both space and time. To date the main focus of the Member States in their approach to Descriptor 11 has been on noise. In the context of the Marine Strategy Framework Directive (MSFD), radioactivity is considered a property of a hazardous substance, not an ‘energy’ component.

“**Underwater noise**” is defined as anthropogenic sounds which may be of short duration (e.g. impulsive such as from seismic surveys and piling for wind farms and platforms, as well as explosions) or long lasting (e.g. continuous such as dredging, shipping, and energy installations). These can affect marine species in different ways. Species that are exposed to noise may be adversely affected over a short time-scale (acute effect) or a long time-scale (permanent or chronic effects). Adverse effects may be both physiological and behavioural and range from subtle (e.g. temporary harm to hearing, behavioural effects) to obvious (in the worst case, death).

The term “**level**”, as used in the MSFD Annex I and in relation specifically to underwater noise, is taken in a wide sense not only to describe sound pressure levels but also other features of sound.

Most commercial activities entailing high noise levels which affect relatively large areas of the sea are executed under regulated conditions subject to a licence. Unlike chemical pollution, noise does not persist in the environment. Thus, if the source of noise is reduced, the amount of noise energy in the water is immediately lowered. There have been very few studies of long-term changes in levels of underwater noise in the oceans. Several studies, all in the northeast Pacific Ocean, suggest that there was a 10 dB increase in offshore marine ambient noise in the 10–50 Hz range during the last 35 years of the 20th century, attributed primarily to increases in commercial shipping traffic<sup>1</sup>. Despite a continuing increase in the number of ships worldwide, it is not known whether ambient noise levels at these frequencies continue to increase; there are probably differences between different regions, not only levels but also in trends. Both offshore pile driving and shipping activities have increased in some European waters in recent decades, but there is no knowledge of changes in ambient noise.

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<sup>1</sup> Andrew, R. K., Howe, B. M., Mercer, J. A., and Dzieciuch, M. A. 2002. Ocean ambient sound: comparing the 1960s with the 1990s for a receiver off the California coast. *Acoustics Research Letters Online*, 3: 65–70.  
McDonald, M., Hildebrand, J., and Wiggins, S. 2006. Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. *Journal of the Acoustical Society of America*, 120: 711–718.

## Linkages with existing relevant EU legal requirements, standards, and limit values

In 2011, JRC identified that “there are no methodological standards available within the framework of European or international conventions relevant to Descriptor 11”<sup>2</sup>.

The non-binding European Commission Guidelines for the establishment of the Natura 2000 network in the marine environment<sup>3</sup> consider noise as a source of pollution that affects the marine environment and biodiversity. The guidelines identify several sources of underwater noise pollution, including the propeller and machinery noise of ships. Member States need to regulate such noise-generating activities in accordance with the provisions of the Habitats Directive if they are likely to have significant effects on protected features at Natura 2000 site or on species strictly protected as listed in Annex IV, including cetaceans.

The work at EU level is coordinated by the **Technical Group on Noise** of the MSFD CIS for further development of Descriptor 11 Noise/Energy.

## Linkages with international and RSC norms and standards

There is no international treaty specifically addressing the issue of noise as a source of pollution.

Pursuant to the United Nations Convention on the Law of the Sea (**UNCLOS, 1982**), there are general duties to protect marine biodiversity (including marine mammals) and prevent, reduce, and control pollution “from any source”. The Convention defines “pollution of the marine environment” as “the introduction by man, directly or indirectly, of substances of or energy into the marine environment, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.” As a form of energy, sound falls under the definition of pollution of the marine environment contained in the UNCLOS and most relevant regional instruments.

Additionally, several international conventions, such as the **UN Convention on Migratory Species (CMS)** and its daughter agreements, recognise underwater noise, including noise from shipping, as a potential threat that needs to be addressed.

Of the regional agreements made under the framework of CMS, **ACCOBAMS** (Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area) and **ASCOBANS** (Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas) have a joint Working Group that addresses underwater noise in order to ensure the best possible advice is generated for the Parties on the topic.

In 2011 the **Convention on Biological Diversity**, in its Decision XI/18 A, started to examine the issues around underwater noise and convened an expert workshop in early 2014 with a view to improving and sharing knowledge on underwater noise and its impacts on marine and coastal biodiversity, and developing practical guidance and toolkits to minimize and mitigate the significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity, including marine mammals.

The Scientific Committee of the **International Whaling Commission (IWC)** has been considering the issue of underwater sound for more than a decade.

The International Convention for the Prevention of Pollution From Ships **MARPOL (73/78)** only defines pollution in terms of introduction of ‘substance’ and not ‘energy’. At the **IMO** level, it was decided in October 2008, based on a proposal by the United States, to add “Noise from commercial shipping and its adverse impact on marine life” as a

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<sup>2</sup> Piha, H and Zampoukas, J. 2011. Review of Methodological Standards Related to the Marine Strategy Framework Directive Criteria on Good Environmental Status, JRC. Available at: <http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/16069/1/lbna24743enn.pdf>

<sup>3</sup> European Commission 2007. Guidelines for the establishment of the Natura 2000 network in the marine environment. Application of the Habitats and Birds Directives. Available at: [http://ec.europa.eu/environment/nature/natura2000/marine/docs/marine\\_guidelines.pdf](http://ec.europa.eu/environment/nature/natura2000/marine/docs/marine_guidelines.pdf)

high priority item to the work programme of its Marine Environment Protection Committee (MEPC). In 2014, the MEPC approved Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life, recognising that underwater noise radiating from commercial ships may have both short- and long-term negative consequences on marine life.

The Baltic Sea region is currently carrying out a project (BIAS) on a common methodology for measuring acoustic data. In the **HELCOM** Initial Holistic Assessment<sup>4</sup> the impact of noise was assessed using a 4-level indicator system and identified noise as “other physical disturbance”: level 1 indicates that the noise is audible to biota; level 2 indicates that masking of communication occurs; level 3 indicates an avoidance reaction; and level 4 indicates physiological impacts. Level 1 and 2 were considered relevant for the major part of the Baltic Sea area at this time.

Currently, no **OSPAR** Contracting Party has incorporated noise into any permanent monitoring programme<sup>5</sup>. In 2009, the OSPAR Commission considered an overview document on the effects of man-made underwater noise on marine life and in its core part documented the effects of sound from human activities on marine life. The OSPAR QSR 2010 also considers the negative effects of anthropogenic underwater noise.

Underwater noise has yet to be addressed by either the **Barcelona** or the **Belgrade Conventions**.

### Definition of GES

The energy descriptor is primarily a ‘pressure’ descriptor. This largely means that if GES is to be achieved, the introduction of energy should not compromise the achievement of GES for marine species (as covered under Descriptors 1 and 3). In its report published in February 2012, the Technical Subgroup on Underwater Noise and other forms of energy (Van der Graaf *et al.*, 2012) made an analysis and provided a number of recommendations with regards to methodological standards and possible threshold values to be used for impulsive sound (Indicator 11.1.1) and ambient noise (Indicator 11.2.1).

### The "climate sensitivity" for D11 (or criteria/indicators)

Descriptor 11 is not directly climate sensitive, but climate-related issues might affect this descriptor. The increase in atmospheric levels of CO<sub>2</sub> not only results in atmospheric climate change but also in ocean acidification, and an increase in sea surface temperature. If climate change leads to an increase in storminess, this will raise ambient underwater noise at the relevant frequencies. It has been claimed that the acidification of marine waters could potentially increase the propagation range of underwater noise<sup>6</sup> but this effect has been shown to be non-significant<sup>7</sup>. Seasonal variations in sea surface temperature (and possibly of water stratification) have been proposed as an explanation of observed seasonal cycles in the amplitude of ambient noise in the frequency range 25 Hz to 50 Hz<sup>8</sup>. While this link requires further investigation, if confirmed, it has implications for long-term trends: specifically, a long-term increase in sea surface temperature would result in a corresponding *decrease* in expected deep-water ambient noise on a global scale, partly compensating for the increase expected due to increased shipping<sup>9</sup>. Such changes would apply to the propagation of both ‘natural’ and anthropogenic underwater sound. As can be seen, there is no certainty about the overall effects of climate change on the transmission of underwater sound.

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<sup>4</sup> HELCOM. 2010. Ecosystem Health of the Baltic Sea 2003–2007: HELCOM Initial Holistic Assessment. Baltic Sea Environment Proceedings No. 122. <http://www.helcom.fi/Lists/Publications/BSEP122.pdf>.

<sup>5</sup> MSFD Advice Manual and Background document on Good environmental status – Descriptor 11: Underwater noise, 2012.

<sup>6</sup> Hester, K. C., Peltzer, E. T., Kirkwood, W. J., and Brewer, P. G. 2008. Unanticipated consequences of ocean acidification: A noisier ocean at lower pH. *Geophysical Research Letters*, 35: L19601.

<sup>7</sup> Reeder, D. B., and Chiu, C-S. 2010. Ocean acidification and its impact on ocean noise: phenomenology and analysis. *Journal of the Acoustical Society of America*, 128, Express Letters: 137–143. DOI: 10.1121/1.3431091.

<sup>8</sup> Ainslie, M.A. 2013. Periodic changes in ambient noise: possible causes and implications for long term prediction. In 1st International Conference and Exhibition on Underwater Acoustics: 655–662.

<sup>9</sup> Ainslie, M. 2012. Potential causes of increasing low frequency ocean noise levels. In Proceedings of Meetings on Acoustics, 12: 070004. Acoustical Society of America.

## Results of the Article 12 assessment (including In-depth assessment)

### Descriptor

A total of fifteen Member States have defined GES at descriptor level and according to MSFD Annex I whilst five Member States have not defined GES for underwater noise. All States Countries who have defined GES for D11 have used different approaches. In addition the definitions provided appear to have been based on different interpretations (in some cases mistranslations) of the 2010 Commission Decision. Two Member States provided a definition of GES that was a copy or very similar to that provided in Annex I of the MSFD. Three Member States included threshold values in their definition. In addition to underwater noise, one Member States included also other forms of energy in their definition, and identified them as light, electromagnetism, and changes in temperature. One Member State reported an elaborate GES definition, stating that GES is achieved when the abundance, mortality risk, and communication behaviour of sensitive species is not affected by underwater noise.

### Criteria

Eleven Member States included the criteria provided in the Commission Decision 2010/477/EU although a few Member States did not make use of both criteria or did not differentiate clearly between them. Three Member States extended the scope of the GES definition in the Decision substantially by adding high-frequency impulsive sounds to their GES definition. Finally, a few Member States had a GES definition that was not, or only roughly in line with the definitions as provided in the Commission Decision.

### Indicators

Not all Member States applied the indicators as provided in the Commission Decision. At the indicator level, only two Member States included details as specified in the Commission Decision.

### Regional coherence descriptor

Although the limited development of the GES definitions by most Member States could provide an opportunity to achieve a high level of regional coherence, in the Northeast Atlantic and Baltic coherence was assessed as low and in the Mediterranean as moderate. Neither of the Black Sea Member States defined GES for Descriptor 11.

### Member State good practices

Three Member States have provided threshold values, meaning that the other definitions are all qualitative. One Member States specifically mentions in their GES definition other forms of energy, namely, emission of light, other electromagnetic fields, and heat.

## Analysis of the current text of the Decision

### ➤ Criteria to be kept in the Decision, in accordance with the mandate provided by the Directive

The following two criteria are clearly the operative part of the Commission Decision and should be kept, but see below for improvements in wording to remove ambiguities.

#### *11.1. Distribution in time and place of loud, low and mid frequency impulsive sounds*

— *Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level (in dB re 1µPa 2.s) or as peak sound pressure level (in dB re 1µPa peak) at one metre, measured over the frequency band 10 Hz to 10 kHz (11.1.1)*

## 11.2. Continuous low frequency sound

— Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1  $\mu$ Pa RMS; average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate (11.2.1).

### ➤ Recommended improvements to wording of Criteria

#### **Indicator 11.1.1. Distribution in time and place of loud, low, and mid-frequency anthropogenic impulsive sounds**

TSG Noise noted (Van der Graaf *et al.*, 2012) that the current Commission Decision of Indicator 11.1 is not unambiguous, and there is a need for an explanation as to how it should be interpreted. TSG Noise (Dekeling *et al.*, 2013) therefore defined “impulsive” in this context as including all sounds of duration less than 10 seconds and recommends improving Indicator 11.1.1 to:

*The proportion of days and their distribution within a calendar year, over geographical locations whose shape and area are to be determined, and their spatial distribution in which either the monopole energy source level (in units of dB re 1  $\mu$ Pa<sup>2</sup> m<sup>2</sup> s), or the zero to peak monopole source level (in units of dB re 1  $\mu$ Pa m) of impulsive anthropogenic sound sources, measured over the frequency band 10 Hz to 10 kHz, exceeds a value that is likely to entail significant impact on marine animals (11.1.1).*

#### **Indicator 11.2.1. Continuous low frequency anthropogenic sound**

There has been some variation in the understanding of the terminology surrounding the complex issue of underwater sound and its effects. TSG Noise (Van der Graaf *et al.*, 2012) therefore defined the terms used in Indicator 11.2.1.

- **Trends:** the Oxford Dictionary defines ‘trend’ as ‘general direction in which something is developing or changing’. Following this, ‘trend’ refers to year-to-year (or longer) changes in ambient noise levels.
- **Average noise level:** TSG Noise realised that the term ‘average noise level’ is not unambiguous; there are different methods to establish a value for an average that are all correct, but lead to different values. TSG Noise recommended defining ‘average noise level’ as ‘average of the squared sound pressure’, since this definition is robust to changes or differences in the duration of individual time samples.
- **Use of models:** Measurements are considered essential to ground truth models. The use of models can strengthen analyses by, for instance, addressing bias introduced by the variability of the spatial distribution of human pressure, and by the natural variability of the environment, and to extend the results of monitoring to poorly or uncovered areas.

Based on these points, TSG Noise recommends improving Indicator 11.2.1 to:

*Trends in the annual average of the squared sound pressure associated with ambient noise in each of two third octave bands, one centred at 63 Hz and the other at 125 Hz, expressed as a level in decibels, in units of dB re 1  $\mu$ Pa, either measured directly at observation stations, or inferred from a model used to interpolate between or extrapolate from measurements at observation stations.*

TSG Noise does not regard these recommended changes as adding any burden to the process of implementing MSFD, but they should ensure further clarity and help ensure that Member States do not vary in their understanding of the indicators.

### ➤ Explicative text

The following part of the Decision provides explanation on the scope of the Descriptor, broadening to include other forms of energy. If not covered by the criteria or indicators, such information is not really necessary in the Commission Decision and may lead to confusion as to whether it should be addressed or not.

*Together with underwater noise, which is highlighted throughout Directive 2008/56/EC, other forms of energy input have the potential to impact on components of marine ecosystems, such as thermal energy, electromagnetic fields, and light.*

➤ **To be taken out of the Decision and included in guidance**

The following part of the Decision should be taken out as it constitutes guidance for assessment methodologies of underwater noise:

*At the current stage, the main orientations for the measurement of underwater noise have been identified as a first priority in relation to assessment and monitoring subject to further development, including in relation to mapping. Anthropogenic sounds may be of short duration (e.g. impulsive such as from seismic surveys and piling for wind farms and platforms, as well as explosions) or be long lasting (e.g. continuous such as dredging, shipping and energy installations) affecting organisms in different ways. Most commercial activities entailing high level noise levels affecting relatively broad areas are executed under regulated conditions subject to a licence. This creates the opportunity for coordinating coherent requirements for measuring such loud impulsive sounds.*

**Conclusions:**

- A slight redrafting of the criteria will make them unambiguous without changing any actions or burden on Member States.
- Monitoring or registering of underwater noise has been very limited to date, resulting in a lack of available data on which to base recommendations.
- There remains a need to define the phrase under 11.1.1 “...likely to entail significant impact on marine animals” for this indicator to be used in defining GES for D11.
- Further research on the effects of the introduction of all forms of energy, including sound, into the marine environment is still needed.
- Not all Member States applied the indicators as provided in the Commission Decision and not all Member States have followed the approach recommended by the Technical Group on Noise in their final report<sup>10</sup>.
- A small number of Member States have defined thresholds on underwater noise levels for Descriptor 11.
- Three Member States expanded the scope of the GES definition beyond the guidance of the Commission Decision to include high-frequency impulsive sounds. This type of noise might not be possible to monitor adequately and the inclusion of this type of noise might originate from a misinterpretation or erroneous translation of the Commission Decision guidance, especially as it relates to technical terms.

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<sup>10</sup> Dekeling, R., et al. 2013. Monitoring Guidance for Underwater Noise in European Seas. Part I: Executive summary. (see also Parts II and III). Available at: <http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/30979/1/lb-na-26557-en-n.pdf>.

**GES criteria (in accordance with Art. 9.3)**

**Proposal to combine criteria for GES**

There is no proposal to combine criteria.

**GES boundaries defined according to limit values**

As noted above, three Member Countries included threshold values for the emission of sound in their definitions of GES relevant to Indicator 11.1.1. Such values apply mainly to certain individual activities in the waters of those Member Countries and aim to protect certain sensitive species. Such values have not been agreed by TSG Noise and do not account for the cumulative effects of exposure to underwater noise that the indicator is designed to address. Further work is required in order to be able to better quantify and understand the phrase “...likely to entail significant impact on marine animals”, whether in relation to individual or cumulative impacts of underwater sound. There are, at present, no clear links between pressure and state responses of underwater noise that would allow clear boundaries or thresholds to be set for either Indicator 11.1.1 or 11.2.1. Precautionary choices could be made, but such choices carry the risk of unnecessary restriction of activities. If such precautionary values were to be considered across Regional Seas, then an extensive stakeholder consultation and other formal assessments would be needed in each Sea. If the pressure indicators on underwater noise are to be clearly linked to good environmental status it will furthermore be necessary to be coherent with any thresholds set in the state indicators (e.g. D1). Underwater noise is not the only pressure on marine species and ecosystems and plainly its significance may vary depending upon other pressures on those species and ecosystems.

**Proposals for new criteria not yet covered**

There are no proposals for new criteria. TSG Noise has developed a paper on “criteria for criteria” to allow consideration of other introductions of energy than those included so far. Once these “criteria for criteria” have been adopted, other forms of energy introduction will be considered. There appears to have been little further research beyond that reviewed by TG11 (Tasker *et al.*, 2010), so it seems unlikely at this time that TSG Noise’s recommendations will differ from those of TG11.

**Link to possible future EEA indicator**

There are no known future EEA indicators.

**GES methodological standards (in accordance with Art. 9.3)**

There are no proposals to change the standard for defining GES. Further research is required to define the relationship between the introduction of underwater energy and the effects on the state of the environment.

**Standardized methods for monitoring for comparability (in accordance with Art. 11.4)**

**Proposals for specifications which aim at improving comparability of monitoring results on the basis of JRC / ICES / RSCs inventories and Article 12 findings linked to proposed criteria**

Dekeling *et al.* (2013a, 2013b, 2013c) provides comprehensive guidance to standardize registration of the location of the distribution in time and place of loud, low, and mid-frequency impulsive sounds and the monitoring of continuous low-frequency sound. TSG Noise is presently seeking the views of Member Countries on the experience of using this guidance and on any problems encountered.

## **Standardized methods for assessment for comparability (in accordance with Art. 11.4 GES)**

**Proposals for specifications which aim at improving comparability of assessment results on the basis of general guidance prepared by Deltares, taking account of JRC / ICES / RSCs inventories and Article 12 findings linked to proposed criteria**

If Member Countries follow the guidance provided by Dekeling *et al.* (2013a, 2013b, 2013c) assessment results should be comparable. Part of this guidance recommends an integrated approach between Member Countries that would involve the establishment of noise registers for Regional Seas, and the collective design of an ambient noise monitoring system to represent each Regional (or possibly sub-Regional) Sea. Such approaches would undoubtedly be more efficient and cost-effective than for each Member Country to establish its own monitoring system. TSG Noise is attempting to determine if there are any particular practical barriers to Member Countries working collectively, with early indications showing that long-term (non-project) funding mechanisms are likely to be an issue (e.g. how would costs of long-term monitoring be shared equitably and in a guaranteed way between relevant Member Countries).

## **Rational and technical background for proposed revision**

**Justification and technical background justifying the above proposals**

The background justifying the above changes is summarized above – further detail can be found in Van der Graaf (2012).

## **Other related products (e.g. technical guidance, reference in common understanding document)**

Dekeling, R. P. A., Tasker, M. L., Ainslie, M. A., Andersson, M., André, M., Castellote, M., *et al.* 2013. Monitoring Guidance for Underwater Noise in European Seas – 2nd Report of the Technical Subgroup on Underwater noise (TSG Noise). Part I – Executive Summary. Interim Guidance Report. 12 pp.

Dekeling, R. P. A., Tasker, M. L., Ainslie, M. A., Andersson, M., André, M., Castellote, M., *et al.* 2013. Monitoring Guidance for Underwater Noise in European Seas – 2nd Report of the Technical Subgroup on Underwater noise (TSG Noise). Part II – Monitoring Guidance Specifications. Interim Guidance Report. 26 pp.

Dekeling, R. P. A., Tasker, M. L., Ainslie, M. A., Andersson, M., André, M., Castellote, M., *et al.* 2013. Monitoring Guidance for Underwater Noise in European Seas – 2nd Report of the Technical Subgroup on Underwater noise (TSG Noise). Part III – Background Information and Annexes. Interim Guidance Report. 66 pp.

## **Reference documents**

Tasker, M. L., Amundin, M., André, M., Hawkins, A., Lang, W., Merck, T., *et al.* 2010. Marine Strategy Framework Directive. Task Group 11 Report, Underwater noise and other forms of energy. European Union and ICES. 58 pp.

Van der Graaf, A. J., Ainslie, M. A., André, M., Brensing, K., Dalen, J., Dekeling, R. P. A., *et al.* 2012. European Marine Strategy Framework Directive – Good Environmental Status (MSFD GES): Report of the Technical Subgroup on Underwater noise and other forms of energy.

## **Descriptor**

*Descriptor 11: Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment*

Together with underwater noise, which is highlighted throughout Directive 2008/56/EC, other forms of energy input have the potential to impact on components of marine ecosystems, such as thermal energy, electromagnetic fields, and light. Additional scientific and technical progress is still required to support the further development of criteria related to this descriptor, including in relation to impacts of introduction of energy on marine life, relevant noise, and frequency levels (which may need to be adapted, where appropriate, subject to the requirement of regional cooperation). At the current stage, the main orientations for the measurement of underwater noise have been identified as a first priority in relation to assessment and monitoring subject to further development, including in relation to mapping. Anthropogenic sounds may be of short duration (e.g. impulsive such as from seismic surveys and piling for wind farms and platforms, as well as explosions) or be long lasting (e.g. continuous such as dredging, shipping, and energy installations), affecting organisms in different ways. Most commercial activities entailing high-level noise levels affecting relatively broad areas are executed under regulated conditions subject to a licence. This creates the opportunity for coordinating coherent requirements for measuring such loud impulsive sounds.

### *11.1. Distribution in time and place of loud, low, and mid-frequency impulsive sounds*

— Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level (in dB re 1 $\mu$ Pa 2.s) or as peak sound pressure level (in dB re 1 $\mu$ Pa peak) at one metre, measured over the frequency band 10 Hz to 10 kHz (11.1.1).

### *11.2. Continuous low-frequency sound*

— Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1 $\mu$ Pa RMS; average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate (11.2.1).