



## Terms of Reference

# A Guide for Assessing and Managing Effects of Underwater Sounds from Navigation Infrastructure Activities

### 1. Background

Previous EnviCom Working Groups have developed procedures addressing the assessment and management of various chemical stressors on the environment as related to navigation and port infrastructure, providing a scientific basis for decision making. These reports did not sufficiently address risks associated with underwater sound in relation to waterborne transport infrastructure construction, operations, and maintenance activities. A new effort is therefore proposed to fill this gap by developing a practical guide derived from existing methods and approaches for informing decision makers managing environmental risk associated with navigation infrastructure projects.

Activities associated with the construction, operation, and maintenance of waterborne transport infrastructure generate underwater sounds. A review of the potential biological effects of underwater sound from such activities in relation to other anthropogenic sources is needed to evaluate their potential ecological risks. A more complete understanding is needed of the sounds produced by waterborne transport infrastructure activities, the potential effects they produce, and how they compare with the hearing frequency ranges of fish and marine mammal species. Recently technical guidelines developed by the NOAA National Marine Fisheries Service (NMFS) proposed acoustic exposure criteria for select marine mammal species; their potential impact on waterborne transport infrastructure needs to be assessed. A risk-based approach is needed that utilizes the available data and other site-specific information appropriate for evaluating underwater sound to provide a broader framework for assessing and managing underwater sound effects on the environment.

### 2. Objective

The objective of the proposed WG is to provide technical information to decision makers regarding the risk assessment and management process for underwater sound. The risk methodology will draw from existing approaches and best practices worldwide and be written using understandable terms. It will build on the WG175 report and show decision makers how to manage risks associated with under water sound from both impulsive (e.g., pile-driving, sonar, etc.) and non-impulsive (e.g., dredging, shipping, etc.) sound sources.

The WG will work closely with other proposed WG related to Working with Nature (WwN) and ecosystem goods and services (EGS) to ensure consistency among the WGs.

A methodology is required to inform risk management decisions for the comprehensive range of environmental risks pertinent to underwater sound related to navigation infrastructure. The WG should provide a practical methodology for managing the likely effects of project components in the context of natural variability in time (short to long term) and space, (e.g., floods, storms, near field/far field), other natural and anthropogenic sources of underwater sounds (e.g., storms, commercial shipping, etc.) and the ability of the identified habitats or species to recover from or compensate for effects i.e., temporary threshold shifts as opposed to tissue damage or mortality. The WG should identify recent case studies, summarizing them in an understandable manner as to how risk was assessed and appropriately managed.

Managing project risks involves considering multiple factors in the environment that affect underwater sound (e.g., substrate type, geomorphology of the waterway, site-specific hydrodynamic conditions, equipment maintenance status, etc.) operating over broad spatial and temporal scales. Large uncertainties related to these factors prevent clear projections about the future performance of risk management actions. The management of risk involves both large economic and environmental costs, and is further complicated by the diverse range of policies, perspectives, risk attitudes and personal values that drive risk management decision making.

The developed risk framework and supporting methodologies will provide the foundation for a decision support system for assessing and managing underwater sound risk related to navigation infrastructure.

### **3. Earlier Reports to be Reviewed**

The report on underwater sound risks will appropriately integrate current knowledge from existing reports and frameworks, such as those recently developed by the PIANC EnviCom Permanent Task Group 3 on Climate Change (PTGCC). It will build on the PIANC EnviCom Working Group 175 report "A Practical Guide to Environmental Risk Management (ERM) for Navigation Infrastructure Projects." Other relevant sources of information include:

- CEDA Information Paper. 2011. Underwater Sound in Relation to Dredging (November)
- CEDA Position Paper. 2011. Underwater Sound in Relation to Dredging. *Terra et Aqua* 125:23-28.
- WODA. 2013. Technical Guidance on: Underwater Sound in Relation to Dredging (June).
- IADC. 2016. Dredging Sound Levels, Numerical Modelling and Environmental Impact Assessment (EIA)
- Joint Nature Conservation Committee (JNCC) 2017. Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys

### **4. Scope**

The EnviCom Working Group (WG) will develop a report that develops a practical and structured management process (framework) through which management actions for reducing environmental risks associated with navigation infrastructure construction, operation, and maintenance are identified, evaluated, selected, and implemented. The process developed should describe available approaches and methods for comparing

and evaluating alternative risk management actions to inform decision-making. It should make clear that projects can differ significantly, thus deferring risk management decisions from simply copying requirements from other projects without substantiating their effectiveness. The process developed should, where possible, be compatible with the WwN concept taking into account existing methods for managing environmental risks while providing an open, deliberative, and transparent decision-making process. The process should:

- Define the concepts of risk and risk-informed decision making;
- Present an integrated approach / framework to navigation infrastructure requirements that is practical and implementable;
- Address such topics as uncertainty (e.g., short-term event-based related to infrastructure operations), long-range risks (e.g., climate change), residual risk, sustainability, resiliency, and collaborative processes;
- Review available methods that support risk-informed decision making so that the uncertainties associated with managing environmental risk of navigation infrastructure operations are recognized and addressed;
- Present risk-informed decision making as a process of shifting toward more sustainable practices for achieving multiple project benefits (i.e., environmental, social and economic) so that the uncertainties associated with managing underwater sound risks are recognized and addressed;
- Discuss the role of sustainability and life-cycle analysis in the context risk management of navigation infrastructure construction, operations and maintenance; and,
- Incorporate adaptive management principles and practices, as appropriate.

In developing the approach, elements addressing issues associated with expert knowledge of the system, including an understanding of the ecosystem, project components and their different construction techniques as well as stakeholder participation should be included as a means of developing a practical approach for addressing underwater sound risks on navigation infrastructure activities.

The report will not attempt to update the effects criteria as published by Southall et al. (2007). Southall et al. (2007). Marine mammal noise exposure criteria: initial scientific recommendations, *Aquatic Mammals* 33(4):411-522.

## **5. Intended Product**

The report shall comprise:

- An introduction to assessing and managing the effects of underwater sounds and how they fit into the existing knowledge base from PIANC, CEDA, WEDA, IADC and others;
- Discussion of progress and approaches developed through Engineering With Nature® and Building with Nature programs being promoted elsewhere in the world;
- A connection with the Ecosystem Goods and Services WG for identifying, characterizing, and substantiating the environmental and other benefits of Working with Nature projects.
- A description of the approach / framework developed; the approach should address the steps and timing needed to meet project objectives in an ecosystem context. The approach must show how stakeholders can be included in the process and identify and exploit triple win solutions by systematically integrating social, environmental and economic considerations into decision making and actions at every phase of an infrastructure project.
- Potential impediments to applying the process and ways in which these can be overcome.

- A focused international survey of existing underwater sound risk assessment and management approaches under consideration of legislative demands.
- An easily understood description of two or more case studies illustrating how risks associated with underwater sounds from navigation infrastructure construction, operations, and maintenance activities can be effectively assessed and managed as informed by a science-based approach as successfully applied in practice.
- A summary of existing PIANC, CEDA, IADC and other publications to ensure the approach developed is practical and integrates current knowledge.
- A summary of potential suitable mitigation strategies and measures for both impulsive and non-impulsive sound sources.

#### **6. Working Group Membership**

Members of the WG should include representatives from the target audience, i.e., consultants, regulators and contractors, and Port Authorities who are tasked with making decisions. The range of expertise should cover at least practical port design and construction knowledge and experience, geomorphology, physical processes, biology, ecology and hydraulic as well as hydro-ecological modeling. A regulator should be included to represent the regulatory perspective.

#### **7. Relevance to Countries in Transition**

The primary audience in both developed and developing countries would be project designers, contractors, ecologists, civil engineers, planners, regulators and environmental stakeholders who have an influence on the decision-making responsibility pertaining to assessing and managing risks associated with underwater sound. The report will be written in a manner easily understood in both developed and transitional countries.

#### **8. Climate Change**

The underwater sound report will consider the role, influences, and implications of climate change and will integrate current knowledge from reports produced by the PIANC Permanent Task Group on Climate Change (PTGCC).