



**jonas**

Joint Framework for Ocean  
Noise in the Atlantic Seas

# 2<sup>nd</sup> ONLINE JONAS WORKSHOP: UNDERWATER SOUND MAPPING APPROACHES

Event Summary & Participant Recommendations

27<sup>th</sup> of April 2022



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## 1 INTRODUCTION

The Joint Framework for Ocean Noise in the Atlantic Seas (JONAS) project, co-funded by the European Regional Development Fund (ERDF) through INTERREG Atlantic Area Programme, aims to streamline the monitoring and risk management of underwater noise in the northeast Atlantic Ocean and support EU member states in meeting the requirements of the Marine Strategy Framework Directive (MSFD). Nine JONAS project partners have teamed up to examine and address the effects of underwater noise on sensitive species through eight interconnected Work Packages (WPs), which include specific project activities such as:

- The production of monthly noise and risk maps based on the spatial modelling of noise characteristics and the distributions of key sensitive species in order to support better planning and decision-making in EU Member States
- The development and demonstration of indicators for the risk of impact from shipping noise that are deemed suitable for OSPAR and MSFD assessment and local underwater noise management
- The development of an online underwater noise visualisation platform, to provide a communal workspace designed to make technical material more accessible and transform it into user-friendly tools and services for use by policymakers and researchers
- The examination of five case studies looking at the impacts and effects of acoustic pollution, ship quieting methods, seismic survey operations, offshore wind energy devices, and acoustic deterrent devices in aquaculture.

More information about JONAS can be found online at [www.jonasproject.eu](http://www.jonasproject.eu) or on Twitter at [@jonas\\_project](https://twitter.com/jonas_project). You can also contact us directly via email at [jonas@ucc.ie](mailto:jonas@ucc.ie).

### // 1.1 JONAS WORKSHOPS

JONAS stakeholder engagement and knowledge exchange between the project and its stakeholders is designed to be of mutual benefit for all involved and participating. A series of workshops act as a focal point for the proactive engagement of JONAS stakeholders. These workshops are designed to interactively present, discuss, develop understanding, and build a consensus around the outputs and management approaches proposed and developed within JONAS. The first JONAS workshop was held on 30 June 2020 and focused on indicator development within the JONAS Risk-Based Approach — considering policy, legal and regulatory needs — and the JONAS underwater noise (UWN) visualisation platform (Kopke

et. al, 2020). This second online workshop was designed to present JONAS Sound Mapping efforts in the context of the MSFD framework (specifically Descriptor 11) to stakeholders. In particular, the discussion was based around sound mapping and uncertainties and explored future research needs for effective decision making with JONAS stakeholders. By incorporating stakeholder feedback, the project hopes to encourage widespread uptake and adoption of developed mapping approaches and resources.

## 2 2<sup>nd</sup> ONLINE JONAS WORKSHOP

### // 2.1 PURPOSE AND OBJECTIVES

This online event aimed to facilitate a knowledge exchange between regulators, policymakers and scientists, focusing on different JONAS sound mapping approaches, uncertainties and future research with the following objectives:

- To showcase sound mapping approaches and associated outputs developed within the JONAS project;
- To discuss uncertainty in relation to the JONAS sound mapping approaches; and
- To explore the direction of future research that can provide support for effective decision making towards minimising the impact from anthropogenic underwater noise contribution to the seas.

### // 2.2 WORKSHOP PARTICIPANTS

The event was designed, trialled, and implemented by JONAS project partners from:

- MaREI, the SFI Centre for Energy, Climate, and Marine Research at University College Cork (MaREI, UCC), who are coordinating the project and responsible for project communication and stakeholder engagement.
- SHOM, the French Naval Hydrographic and Oceanographic Service, who are ensuring the coordination with national competent authorities and play an active role in noise mapping and uncertainties assessments.
- Quiet-Oceans, a French-based consultancy that specialises in underwater noise, who are leading the noise risk assessment for the project and are developing methodologies and implementation of risk mapping in JONAS; and
- University of Algarve (UAAlg), specifically SiPLAB who specialises in underwater acoustic propagation, model calibration, and noise measurement and have developed,

implemented and tested at-sea methodologies for noise monitoring to comply with and support MSFD indicator D11 in JONAS.

JONAS partners from PLOCAN (the Oceanic Platform of the Canary Islands) — who are leading on JONAS capitalisation efforts and are responsible for the JONAS Underwater Noise Visualisation Platform — also participated in the workshop. Ten project stakeholders brought their expertise to the JONAS online workshop, representing nine organisations, which are outlined in Table 1.

**Table 1: List of organisations represented at the 2<sup>nd</sup> online JONAS workshop, including their types, and countries, and the context of their work in underwater noise.**

ORGANISATION	TYPE & COUNTRY	CONTEXT
<b>Rijkswaterstaat (RWS)</b>	Government Agency, Netherlands	RWS is the Directorate-General for Public Works and Water Management and is part of the Ministry of Infrastructure and Water Management of the Netherlands. RWS is responsible for MSFD national monitoring, which includes D11: Energy incl. Underwater Noise.
<b>Ministerio para la Transición Ecológica y el Reto Demográfico, (MITECO)</b>	Ministry, Spain	Ministry for Ecological Transition and Demographic Challenge (MITECO) is a Department of the Government of Spain responsible for developing government policies concerning environmental issues that include policy and regulation, addressing, for example, D11: Energy incl. Underwater Noise.
<b>Museu da Baleia</b>	Museum, Madeira, Portugal	The Madeira Whale Museum has been developing studies of cetaceans in the Madeira archipelago over the past few years. Scientific research in the Madeira Whale Museum focuses on cetaceans and the marine environment, which is highly relevant in terms of impacts of underwater noise.
<b>Department of Housing, Local Government, and Heritage, Ireland (DPHLG)</b>	Government Department, Ireland	The Department of Housing, Local Government and Heritage is a department of the Government of Ireland. The marine division of the DHLG is responsible for the implementation of the Marine Strategy Framework Directive including D11: Energy incl. Underwater Noise.
<b>Spanish Institute of Oceanography (IEO)</b>	Public Research Organisation, Spain	IEO is dedicated to research in marine science, especially in relation to scientific knowledge of the oceans, which includes underwater noise e.g., in relation to MSFD and D11 and implementation concerning acoustic continuous noise.

<p><b>National Research Council of Italy, Institute of Marine Sciences (CNR-ISMAR)</b></p>	<p>National Research Council, Italy</p>	<p>CNR-ISMAR is currently coordinating the Italy-Croatia Interreg project SOUNDSCAPE (Soundscape in the North Adriatic Sea and their impact on marine biological resources), among many other highly relevant research projects.</p>
<p><b>Laboratory of Mechanics and Acoustics (LMA)</b></p>	<p>Research Unit, France</p>	<p>The LMA is a Research Unit of the Aix-Marseille University and is linked to the French National Centre for Scientific Research Institute of Engineering Sciences and Systems (INSIS). LMA is specialised in Acoustics and Solid Mechanics and aims for a fundamental research-engineering-technology continuum while emphasizing a system approach, which includes research relevant to addressing issues associated with impacts of underwater noise.</p>
<p><b>World Ocean Council (WOC)</b></p>	<p>International Organisation</p>	<p>The World Ocean Council is a global, cross-sectoral ocean industry leadership alliance committed to Corporate Ocean Responsibility. WOC addresses cross-cutting issues affecting ocean sustainable development, science, and stewardship of the seas, which includes addressing issues associated with underwater noise.</p>
<p><b>TNO</b></p>	<p>Research Organisation, Netherlands</p>	<p>TNO, the Netherlands Organisation for applied scientific research, is an independent research organisation. TNO is involved in numerous research projects, which includes projects addressing issues associated with underwater noise.</p>

Individual workshop participants have not been named within this report to ensure data protection is in line with GDPR regulations. However, the project team is happy to assist readers of this document to establish contact with workshop participants, if their expressed permission is granted.

## // 2.3 WORKSHOP STRUCTURE & PRESENTATIONS SUMMARY

It was of utmost importance for the JONAS project team to engage with stakeholders in a way that fostered open and constructive dialogue. We also wanted to build on the successful approach taken during the first online workshop, incorporating the feedback provided by participants in a post-workshop questionnaire. Based on this feedback, the second workshop was divided equally into presentations — where information was provided by the project team — and participatory segments that allowed for stakeholder input, feedback, and discussion.

Participatory segments of the workshop included open periods for questions after every presentation to allow for clarification and understanding of all aspects presented during the workshop, as well as a guided conversation that allowed participants to provide their views and insights by either requesting to speak verbally or by commenting in the workshop platform's chat function. The workshop began with an overview of the JONAS project presented by Project Coordinator Gerry Sutton of MaREI, UCC, which was followed by three detailed presentations of the JONAS sound mapping approaches and a facilitated conversation. The full agenda for the workshop is shown in Table 2 and all presented approaches are summarised below:

### **JONAS noise maps and MSFD D11C2 assessment**

David Dellong & Florent Le Courtois (SHOM)

The statistical methodology used to develop daily large-scale noise maps was presented. Based on the associated results, an example of practical implementation for risk assessment on masking and behavioural changes was also shown. Additionally, a model for comparing measurements was presented along with the noise map confidence assessment methodology. While the models would benefit from improving confidence, the presentation highlighted compliance between the presented JONAS noise maps and MSFD requirements — specifically D11C2 assessment.

### **Towards Realistic Sound Maps**

Sergio M. Jesus, C. Soares, R. Duarte, M. Romagosa, F. Zabel & M. Silva (UAIG)

This presentation focused on sound maps as model predictions of the sound pressure level (SPL) distribution for a given area, time, and frequency band. There is a well-known list of reasons why model predictions fail (erroneous inputs, discretization errors, environmental mismatch, AIS missing targets, etc), thus it is not only essential to compare these sound maps to data, but to use that data — model comparison to improve sound maps through "field calibration".

A new method for field calibration based on Bayes statistical inference was introduced, where an alternative data model is used to allow for two types of model adjustment: 1) a linear transform in the SPL dB space aimed at systematic error correction, and 2) probability density function (PDF) correction based on model and data statistical inference. A test case with a June 2018 data set recorded at three sites in the Azores

showed the results of the corrected model, data, and calibrated PDFs for each 1/3 octave frequency band between 40 and 1000 Hz. A strategy was also proposed for addressing and overcoming problems associated with calibration validation in space and time.

### **High Resolution Sound Mapping in the Atlantic Area**

Thomas Folegot, D. Clorennec, A. Levaufre, R. Chavanne, & R. Gallou (Quiet Oceans).

As part of implementing the MSFD, one year of monthly, quarterly, and annual statistical high-resolution sound maps across the north-east Atlantic Ocean based on real oceanographical data were developed within JONAS. Three types of statistical sound maps have been produced: natural sound maps based on wind data, shipping sound maps based on ship information from the Automatic Identification System (AIS), and excess sound maps. These sound maps have spatial resolutions of a few hundred meters on an area exceeding 400km x 400km and water depths up to a couple of thousand meters. All high-resolution sound maps are available through the Quonops Web Platform, through an Application Programming Interface (API), and all high-resolution sound maps have been made accessible to the JONAS Virtual Research Environment (VRE) platform. The high-resolution sound maps have also been used in JONAS to assess pressure indexes and establish risk maps.

### **Guided Conversation**

Kathrin Kopke & Amy Dozier (MaREI, UCC)

The workshop continued with a guided conversation that focused on “Uncertainty & the Future Direction of Mapping for Effective Decision Making on Underwater Noise.” The discussion reflected on and related to the three JONAS sound mapping approaches that were presented. The guided conversation approach was developed for this online context and facilitated by Kathrin Kopke of MaREI, UCC, who adapted the Group Facilitation Methods developed by the Institute of Cultural Affairs (ICA). The guided conversation applied an ORID (Objective, Reflective, Interpretive, Decisional) method to entice participants to engage and to ensure interactions are comfortable for all involved within the online workshop setting. This method allowed for a more structured approach to foster dialogue between JONAS project partners and workshop participants and gather meaningful input and feedback for project members on the three mapping approaches.



**Table 2: Workshop Agenda**

<b>JONAS UNDERWATER SOUND MAPPING WORKSHOP AGENDA</b>	
10:30 – 10:35	Welcome – Kathrin Kopke, UCC
10:35 – 10:50	Introduction To Jonas - Gerry Sutton, UCC
10:50 – 11:05	JONAS noise maps and MSFD D11 assessment - Florent Le Courtois and David Dellong, SHOM
11:05 – 11:20	Q/A with SHOM
11:20 – 11:35	Field calibration of ocean sound maps - Sergio M. Jesus and Ricardo Duarte, UAlg
11:35 – 11:45	Q/A with University of Algarve
11:45 – 11:55	SHORT BREAK
11:55 – 12:10	High resolution sound mapping across the Atlantic Area - Thomas Folegot, Quiet-Oceans
12:10 – 12:22	Q/A with Quiet-Oceans
12:25 – 12:45	A Conversation about Uncertainty with JONAS (SHOM, UAlg, Quiet Oceans) facilitated by Kathrin Kopke
12:45 – 13:00	Summary and Wrap Up - Gerry Sutton, UCC

## // 2.4 POST-WORKSHOP EVALUATION

The JONAS project team invited workshop participants to take part in a short post-workshop evaluation survey to provide the opportunity for feedback on the event, as well as to allow the project to assess and improve the quality and relevance of JONAS stakeholder engagement. Six out of nine workshop participants chose to take part.

All respondents' scores for questions on a five-point Likert scale showed they felt positive towards the duration and organisation of the event, as well as the quality of the presented material. All survey respondents indicated that the event was relevant to their work, with four of the respondents suggesting that participation may influence their future work. Five respondents also indicated that workshop participation supports engagement with people working in the same field. Multiple choice questions showed that for five respondents, the presentations, the three Q&A sessions and the guided conversation were equally useful in relation to their purpose of attending the workshop.

In open-ended comments, respondents welcomed this type of workshop and stated that they like to have more workshops with the topic of sound mapping, which was highlighted to be

very important to participants, especially in terms of assessing the contribution of anthropogenic underwater noise to the marine environment. Both technical discussions and clarity of the presentations were welcomed by respondents, and the workshop was perceived to be well balanced in time. Participants also appreciated the opportunity to interact at length with the speakers.

### 3 GUIDED CONVERSATION RESULTS

The guided conversation involved a series of questions posed to workshop participants. These were carefully chosen to encourage reflection on the sound mapping approaches presented, particularly in relation to uncertainties. Additionally, the questions aimed to investigate future research needs to support informed decision making, which is needed to reduce anthropogenic underwater noise. The questions were posed in a way that allowed participants to explore certain areas of interest in more detail, to highlight potential issues, and to identify what direction relevant future research should take.

#### // 3.1 MODELLING, MAPPING, AND UNCERTAINTY

Workshop participants highlighted that uncertainty is a very complex topic and an important challenge in underwater sound mapping. Participants noted that the modelling approaches presented help to understand the whole system and provide an opportunity to study potential solutions, whereas focusing solely on reducing uncertainties (e.g. around measurements) would be less effective. However, participants cautioned that any measurements which inform these models aren't comprehensive and have inherent weaknesses.

Models inherently simplify complex processes, and the choices surrounding what to include in these models need to be conveyed to decision makers to address uncertainty and manage expectations. In the discussion, participants compared sound modelling and mapping to weather forecasting — highlighting that weather forecasting has been improved by 70+ years of research, while ocean sound mapping research is comparatively in its infancy (only about a decade old). This weather forecasting analogy was considered useful to help people understand what researchers in the field are doing and the outcomes being sought. Overall, participants highlighted that the JONAS sound mapping approaches show great progress, and further advances in sound mapping should reveal the most useful combinations of maps and approaches that can help navigate uncertainties. Participants noted that further research is needed to assess risk and provide answers concerning sources of uncertainty and how they

can be managed. However, workshop participants emphasised that sound maps help to better understand anthropogenic underwater noise compared to visualisations of shipping traffic on its own. Sound maps allow researchers to pick apart subtleties in space and time, which is important to support informed decision making (for example, in relation to what activities can coexist at a certain time and in a defined place).

The availability of different approaches, measurements, and models was identified as a strength; however, these must be brought together to capture the most accurate predictive approach and to provide good guidance for decision makers — particularly in meeting the requirements of Good Environmental Status under the MSFD. Participants felt that the future holds an opportunity for ensemble modelling, and that multidisciplinary interaction is going to be vital in such processes and to take advantage of future technological advances.

### // 3.2 FUTURE APPROACHES - INFORMATION, FEATURES & FUNCTIONALITY

Both in JONAS and related EU-funded projects, researchers have made great progress in developing modelling and mapping approaches that can provide insight on anthropogenic ocean noise and how to reduce it. Along with improving our predictive capabilities through more robust models, workshop participants highlighted the need to improve our understanding of the basic mechanisms and physics of sound in aquatic environments. Moreover, researchers need to better understand how making ships quieter or adjusting ship speed or shipping lanes can change the sound field — and if such actions are indeed reducing anthropogenic underwater noise.

Participants expect future changes in the technologies that will be employed to interact with sound maps. VR headsets were brought up as an example of a tool that could be harnessed to increase conceptual understanding of sound maps. Understanding the complexities associated with anthropogenic underwater noise can take extensive time and learning, and participants emphasised the importance of presenting this topic in an accessible way. Participants suggested that developing a decision-making tool for calculating scenarios would be beneficial. Policy and decision makers must balance all the competing human activities in a given sea space, including fisheries, shipping, and wind farms with the preservation of the environment, which is an enormous challenge. Integrating underwater sound considerations with marine spatial planning in a user-friendly tool would be very useful to decision makers and practitioners.

## 4 KEY RECOMMENDATIONS

Direct stakeholder feedback collected through e-mails and via the post-workshop evaluation survey showed that participants had a positive experience and that this format of stakeholder engagement was useful for all involved. Specific recommendations given by participants have been summarised in the below bullets.

- The diversity of sound mapping approaches is important to facilitate exploration but there is a need to take stock of, evaluate, and select a set of common approaches.
- An assessment of sound mapping approaches and the different models developed is necessary to identify which approaches are the most accurate so that ensemble modelling can be undertaken
- There is a need to better understand and communicate limitations of the models to serve informed decision making.
- Understanding the underlying mechanisms of how potential policy actions and measures change the sound field (e.g., implementing restrictions on ship speed) is key, even if measurements aren't perfect. If those mechanisms are understood, informed support can be provided to decision makers.
- Sound mapping approaches cannot be the only answer for risk assessments and need to be integrated with other tools and approaches to provide fully developed decision support systems.

The JONAS project team would like to thank all workshop participants for taking the time to attend this workshop and for their effort and expertise, which contributed to and shaped the event.